Waterloo Metro Quarter Over Station Development - Southern Precinct

Construction Noise and Vibration Management Plan

WMQ-SITE-STA-PM-MPL-0018

Revision

Revision	Date	Comment	Prepared By	Approved By
001	16/12/2022	Draft issue	James Ashpole/Ali Ahmadi	Elle Hewett
002	23/12/2022	Update following John Holland comments	James Ashpole/Ali Ahmadi	Elle Hewett
A	10/01/2023	Issued to Planning for Approval	James Ashpole/Ali Ahmadi	Elle Hewett
B	13/01/2023	Addition of Appendix E	James Ashpole/Ali Ahmadi	Elle Hewett
C	07/03/2023	Re-issue responding to DPE's Comments	James Ashpole/Ali Ahmadi	Elle Hewett
D	14/03/2023	Further issue responding to additional DPE's comments	James Ashpole/Ali Ahmadi	Elle Hewett
E	15/03/2023	Further issue responding to additional DPE's comments	James Ashpole/Ali Ahmadi	Elle Hewett
F	12/04/2023	Update to include the use of vibratory roller in expected construction equipment	James Ashpole/Ali Ahmadi	Elle Hewett
G	28/04/2023	Additional updates as per comments	James Ashpole	Mathew McGrory
H	28/04/2023	Addressing DPE Comments	James Ashpole	Mathew McGrory
I	28/06/2024	Inclusion of Mod 3 Extended Construction Works	Jake Emmett	Mathew McGrory

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Executive summary

This Construction Noise and Vibration Management Sub-Plan (CNVMP) has been prepared by Stantec (Australia) Pty Ltd for the Southern Precinct over station development (OSD) at the Waterloo Metro Quarter site.

Documents reviewed:

- Waterloo Metro Quarter Over Station Development – *Environmental Impact Statement Appendix K – Noise and Vibration Impact Assessment, SSD-10437 Southern Precinct,* prepared by Stantec dated 30th September 2020
- B3 Plant, Equipment and Materials – provided by John Holland
- B4 Plant, Equipment and Materials – provided by John Holland
- CNVMP Program – provided by John Holland
- Site Plan A02.001[3] Demolition R1
- Site Plan A02.001[3] Shoring R1
- Waterloo Metro Quarter, Community Communication Strategy: Station Construction and Over Station Development – *SMCSWSWL-JHG-SWL-CL-PLN-000001,* prepared by John Holland, dated December 2022.
- Documentation relating to Modification 3 (SSD-10437-Mod-3)
- Waterloo Metro Quarter - Construction Noise and Vibration Impact Assessment for OOH Works WMQ-46198-STA-AC-RE-CNVIA-OOH-007, prepared by Stantec dated 15th May 2024

Standards/Guidelines/ policies:

- Interim Construction Noise Guideline (ICNG), NSW DECC, 2009
- Construction Noise Strategy, Transport for NSW, 2019
- Noise Policy for Industry (NPI) NSW EPA, 2017
- Assessing vibration: A Technical Guideline, NSW DEC, 2006
- AS 2436:2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites*
- British Standard BS 5228: Part 1:1997 *Noise and Vibration Control on Construction and Open Sites*
- British Standard BS 7358:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground-borne Vibration*
- German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures*

The following construction noise and vibration assessments were conducted as part of this construction noise and vibration impact assessment:

- Noise generated during the construction of the proposed development and associated impacts on the surrounding noise sensitive receivers; and
- Vibration generated during the construction of the proposed development and associated impacts on the surrounding vibration sensitive receivers.

Construction noise impact assessment for the following stages has been carried out:

- Stage 1 – Tree Removal
- Stage 2 – Remediation and Retaining wall works
- Stage 3 – Piling Works
- Stage 4 – Additional Piling and concurrent demolition works
- Stage 5 – Excavation
- Stage 6 – Structure
- Stage 7 – Internal fit-out works and landscaping

Based on the construction noise assessment, the proposed construction works have the potential to give rise to adverse noise impacts at identified receivers. Therefore, efforts should be made on site to assist in reducing the overall noise emissions on site, as per the recommendations in Section 8. It is noted, however, the Average-case scenario is expected to represent the average noise expected from the entire site at a receiver and expected to be representative of the longer-term average noise emissions. Therefore, this situation represents typical average construction noise emissions which are predicted to be below the 'Highly Noise Affected' criterion at the nearest identified residential receivers in most instances.

However, at the most affected residential receiver R3 located at 122 Wellington Street – 134 Wellington Street occasional exceedances above of the established criteria are expected up to 21dB A and 25dBA for the average-case and worst-case scenarios respectively.

Vibration monitoring for the proposed works has been outlined in Section 8.6 to ensure no adverse impacts occur on nearby sensitive receivers.

The table below outlines the Conditions under SSD-10437 condition C22 for the construction noise and vibration management sub-plan for the Southern Precinct works for the Waterloo Metro Quarter Development.

Condition under C22(b)	Report Section
(i) identification of the specific activities that will be carried out and associated noise sources at the premises;	Section 1 Section 5.4
(ii) identification of all potentially affected sensitive residential receiver locations;	Section 2.2
(iii) quantification of the rating background noise level (RBL) for sensitive receivers, as part of the Sub-Plan, or as undertaken in the EIS;	Section 3 Section 3.2 Section 3.3
(iv) the construction noise, ground-borne noise and vibration objectives derived from an application of the EPA Interim Construction Noise Guideline (ICNG), as reflected in conditions of approval;	Section 4
(v) prediction and assessment of potential noise, ground-borne noise (as relevant) and vibration levels from the proposed construction methods expected at sensitive receiver premises against the objectives identified in the ICNG and conditions of approval;	Section 5 – Noise Section 7 – Vibration
(vi) where objectives are predicted to be exceeded, an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise and vibration impacts;	Section 8
(vii) description of management methods and procedures, and specific noise mitigation treatments/measures that can be implemented to control noise and vibration during construction;	Section 8 Section 8.4 Appendix A
(viii) where objectives cannot be met, additional measures including, but not necessarily limited to, the following should be considered and implemented where practicable; reduce hours of construction, the provision of respite from noise/vibration intensive activities, acoustic barriers/enclosures, alternative excavation methods or other negotiated outcomes with the affected community;	Section 8
(ix) where night-time noise management levels cannot be satisfied, a report shall be submitted to the Planning Secretary outlining the mitigation measures applied, the noise levels achieved and justification that the outcome is consistent with best practice;	Section 5
(x) measures to identify non-conformances with the requirements of the Sub-Plan, and procedures to implement corrective and preventative action;	Section 8.4 Appendix D

Condition under C22(b)	Report Section
(xi) suitable contractual arrangements to ensure that all site personnel, including sub-contractors, are required to adhere to the noise management provisions in the Sub-Plan;	Section 8.7
(xii) procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity;	Section 8.4
(xiii) measures to monitor noise performance and respond to complaints;	Section 8.6
(xiv) measures to reduce noise related impacts associated with offsite vehicle movements on nearby access and egress routes from the site;	Section 6 Section 8
(xv) procedures to allow for regular professional acoustic input to construction activities and planning; and	Section 8.8
(xvi) effective site induction, and ongoing training and awareness measures for personnel (e.g. toolbox talks, meetings etc).	Section 8.5
(xvii) amendments and updates in relation to the approved extended construction hours in Condition D5 including inclusion of the noise management strategies identified in Section 8 of the Construction Noise and Vibration Impact Assessment for OOH Works dated 15 May 2024 prepared by Stantec.	Section 8

Condition under C22(c)	Report Section
(C) prior to carrying out any works under Conditions D5(c) to (f), an amended Construction Noise and Vibration Management Sub-Plan (CNVMP) must be prepared, and a copy submitted to the satisfaction of the Planning Secretary and a copy by submitted to the Certifying Authority. The Amended Sub-Plan shall incorporate procedures for:	Section 8
(i) a program of regular, no less frequent than monthly intervals, of attendant noise monitoring at the identified noise sensitive receivers during extended construction hours approved under Condition D5	Section 8.6
(ii) an additional long-term noise monitor to be installed at the southern end of the construction site as identified in Figure 4 of the Construction Noise and Vibration Impact Assessment for OOH Works dated 15 May 2024 prepared by Stantec	Section 8.6
(iii) the results of the above attendant and long-term monitoring shall be used by the project environmental representative to identify all feasible measures to reduce noise related impacts of these works. Records of the monitoring and response by the acoustic consultant and project team, as well as complaints register and response, are to be provided to the Planning Secretary upon request.	Section 8.7

Part 1: Construction Noise and Vibration Assessment

1. Introduction

Stantec Australia has been engaged to prepare a Construction Noise and Vibration Management Sub-Plan (CNVMP) for the Southern Precinct over station development (OSD) at the Waterloo Metro Quarter site, encompassing Building 3, 4 and Cope Street Plaza.

The works as described below are expected to occur across approximately 24 months of work. The works are to be carried out in the following stages as detailed by the construction program dated 24/11/2022 prepared and provided by John Holland:

- Stage 1: Tree Removal
  - Tree Removal – Chainsaw and Mulcher – one day of work expected
- Stage 2: Remediation and retaining wall works
  - Concrete hardstand removal for remediation
  - Ground Preparation for retaining walls
  - Retaining Wall to Botany St and Church
- Stage 3: Piling works
  - Drilling Bored Piles (within 5m of station box)
- Stage 4: Additional piling and concurrent demolition works
  - Concrete hardstand removal for pile caps and bases
  - Pile cropping (within 5m of station)
  - Station capping beam and shoring wall demolished
  - Drilling bored piles (remaining)
- Stage 5: Excavation
  - Pile Cropping (remaining)
  - Drilling Bored Piles (remaining)
  - Sheet Piling
  - Excavation for core bases and pile caps
  - From, Reinforce and Pour Concrete (FRP) bases
  - Backfill and compact
  - Detailed excavation
  - Form, Reinforce and Power Concrete (FRP) Pile caps
- Stage 6: Structure
  - Building 3 Slabs and verticals
  - Building 4 Slabs and verticals

- Jumpform 3
- Jumpform 4
- Building 3 Façade works
- Building 4 Façade works

- Stage 7: Internal Fitout Works and Landscaping

Certain tasks are expected to be carried out concurrently with time periods that are significant in duration. The approach of this assessment is to define and assess stages of work with tasks and use of equipment expected to occur simultaneously based on the provided the construction program.

The tree removal work where a chainsaw and mulcher will be used has been assessed as a separate Stage. The purpose of assessed this in its own individual stage is for the benefit of and accuracy of the modelling process. Whilst this stage will use noisy equipment, the anticipated duration is short, being only one day, and to include this work in other stages, may skew the longer-term noise predictions at receivers for the other phases of works, which is why it was opted to isolate these works into their own individual phase.

Construction works would predominantly be completed within standard hours. Currently, some activities may be carried out outside standard hours under the approved Modification 3 application (SSD-10437-Mod-3) and the associated Modification of Development Consent (dated June 2024). A summary of the approved construction hours including the OOHW are summarised below:

D3. Construction, including the delivery of materials to and from the site, may only be carried out between the following hours:

a) between 7am and 6pm, Mondays to Fridays inclusive; and

b) between 7:30am and 6pm, Saturdays.

D4. Except as permitted in Condition D5, no work may be carried out on Sundays or public holidays

D5. Work/activities may be undertaken outside of the hours specified in Condition D3 and D4 under the following circumstances:

a) If required by the Police or a public authority for the delivery or removal of vehicles, plant or materials, or

b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm, or

c) if a relevant utility service operator has advised the Applicant in writing that carrying out the works and activities would result in a high risk to the operation and integrity of the utility network, or

d) concrete pours or finishing works may finish after 6pm and no later than 10pm Monday to Friday on a maximum of two occasions per calendar month, or

e) hoist and crane climbing or dismantling between 8am and 5pm on Sunday for a maximum of two Sundays over the duration of the project where it can be demonstrated that the work cannot be undertaken during the standard construction hours in Condition D3, or

f) internal fit-out and services installation/commissioning up to 24 hours a day (excluding Sundays and public holidays) behind a closed facade capable of achieving a minimum of 30dB(A) noise reduction from the equipment used and subject to the use of the goods lift only.

It is expected that the impact from the internal fit-out and landscaping works will be insignificant and are unlikely to cause significant impact on the surrounding receivers. Noise from the fit-out works have been assessed in the Out-of-Hours (OOH) Construction Noise and Vibration Impact Assessment (ref WMQ-46198-STA-AC-RE-CNVIA-OOH-007 dated 15 May 2024)

This Construction Noise and Vibration Management Sub-Plan provides:

i. identification of the specific activities that will be carried out and associated noise sources at the premises;

ii. identification of all potentially affected sensitive residential receiver locations;

iii. quantification of the rating background noise level (RBL) for sensitive receivers, as part of the Sub-Plan, or as undertaken in Appendix K of the EIS;

iv. the construction noise, ground-borne noise and vibration objectives derived from an application of the EPA Interim Construction Noise Guideline (ICNG), as reflected in conditions of approval;

v. prediction and assessment of potential noise, ground-borne noise (as relevant) and vibration levels from the proposed construction methods expected at sensitive receiver premises against the objectives identified in the ICNG and conditions of approval;

vi. where objectives are predicted to be exceeded, an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise and vibration impacts;

vii. description of management methods and procedures, and specific noise mitigation treatments/measures that can be implemented to control noise and vibration during construction;

viii. where objectives cannot be met, additional measures including, but not necessarily limited to, the following should be considered and implemented where practicable; reduce hours of construction, the provision of respite from noise/vibration intensive activities, acoustic barriers/enclosures, alternative excavation methods or other negotiated outcomes with the affected community;

ix. where night-time noise management levels cannot be satisfied, a report shall be submitted to the Planning Secretary outlining the mitigation measures applied, the noise levels achieved and justification that the outcome is consistent with best practice;

x. measures to identify non-conformances with the requirements of the Sub-Plan, and procedures to implement corrective and preventative action;

xi. suitable contractual arrangements to ensure that all site personnel, including sub-contractors, are required to adhere to the noise management provisions in the Sub-Plan;

xii. procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity;

xiii. measures to monitor noise performance and respond to complaints;

xiv. measures to reduce noise related impacts associated with offsite vehicle movements on nearby access and egress routes from the site;

xv. procedures to allow for regular professional acoustic input to construction activities and planning; and

xvi. effective site induction, and ongoing training and awareness measures for personnel (e.g. toolbox talks, meetings etc).

xvii. amendments and updates in relation to the approved extended construction hours in Condition D5 including inclusion of the noise management strategies identified in Section 8 of the Construction Noise and Vibration Impact Assessment for OOH Works dated 15 May 2024 prepared by Stantec.

This report has been prepared with the following references:

- Waterloo Metro Quarter Over Station Development – Environmental Impact Statement Appendix K – Noise and Vibration Impact Assessment, SSD-10437 Southern Precinct, prepared by Stantec dated 30th September 2020
- Building 3 Plant, Equipment and Materials – provided by John Holland

- Building 4 Plant, Equipment and Materials – provided by John Holland
- CNVMP Program – provided by John Holland
- Site Plan A02.001[3] Demolition R1
- Site Plan A02.001[3] Shoring R1
- Waterloo Metro Quarter, Community Communication Strategy: Station Construction and Over Station Development – SMCSWSWL-JHG-SWL-CL-PLN-000001, prepared by John Holland, dated December 2022.
- Construction Noise and Vibration Impact Assessment for OOH Works - WMQ-46198-STA-AC-RE-CNVIA-OOH-007 dated 15/05/2024
- Modification of Development Consent (SSD-10437-MOD-3) dated June 2024

Standards/Guidelines/ policies:

- *Interim Construction Noise Guideline* (ICNG), NSW DECC, 2009;
- *Noise Policy for Industry (NPI)*, NSW EPA, 2017
- *Assessing Vibration: A Technical Guideline*, NSW DEC, 2006
- AS 2436:2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*
- British Standard BS 5228: Part 1:1997 *Noise and Vibration Control on Construction and Open Sites*
- British Standard BS 7358:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground-borne Vibration*
- German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures*

The predicted noise levels are based on the proposed construction program and equipment lists provided in this report.

2. Project Description – Waterloo Metro Quarter (WMQ) Over Station Development

2.1 The site

The site is located within the City of Sydney Local Government Area (LGA). The site is situated about 3.3 kilometres south of Sydney CBD and eight kilometres northeast of Sydney International Airport within the suburb of Waterloo.

The Waterloo Metro Quarter site comprises land to the west of Cope Street, east of Botany Road, south of Raglan Street and north of Wellington Street (refer to Figure 1). The heritage-listed Waterloo Congregational Church at 103–105 Botany Road is within this street block but does not form a part of the Waterloo Metro Quarter site boundaries.

The Waterloo Metro Quarter site is a rectangular shaped allotment with an overall site area of approximately 1.287 hectares. The description of the site is defined by Lot 190 in DP 1257150. The boundaries of the overall site are identified at Figure 1, and the subject site as per the detailed SSDA is identified at Figures 2 and 3. The site is reasonably flat with a slight fall to the south.

The site previously included three to five storey commercial, light industrial and shop top housing buildings. All previous structures except for an office building at the corner of Botany Road and Wellington Street have been demolished to facilitate construction of the new Sydney Metro Waterloo station. As such the existing site is predominately vacant and being used as a construction site.

Construction of the Sydney metro station box and tunnel is currently underway on site in accordance with critical State significant infrastructure approval (CSSI 7400).

Figure 1 - Aerial image of the overall WMQ OSD site

The area surrounding the site consists of commercial premises to the north, light industrial and mixed-use development to the south, residential development to the east and predominantly commercial and light industry uses to the west.

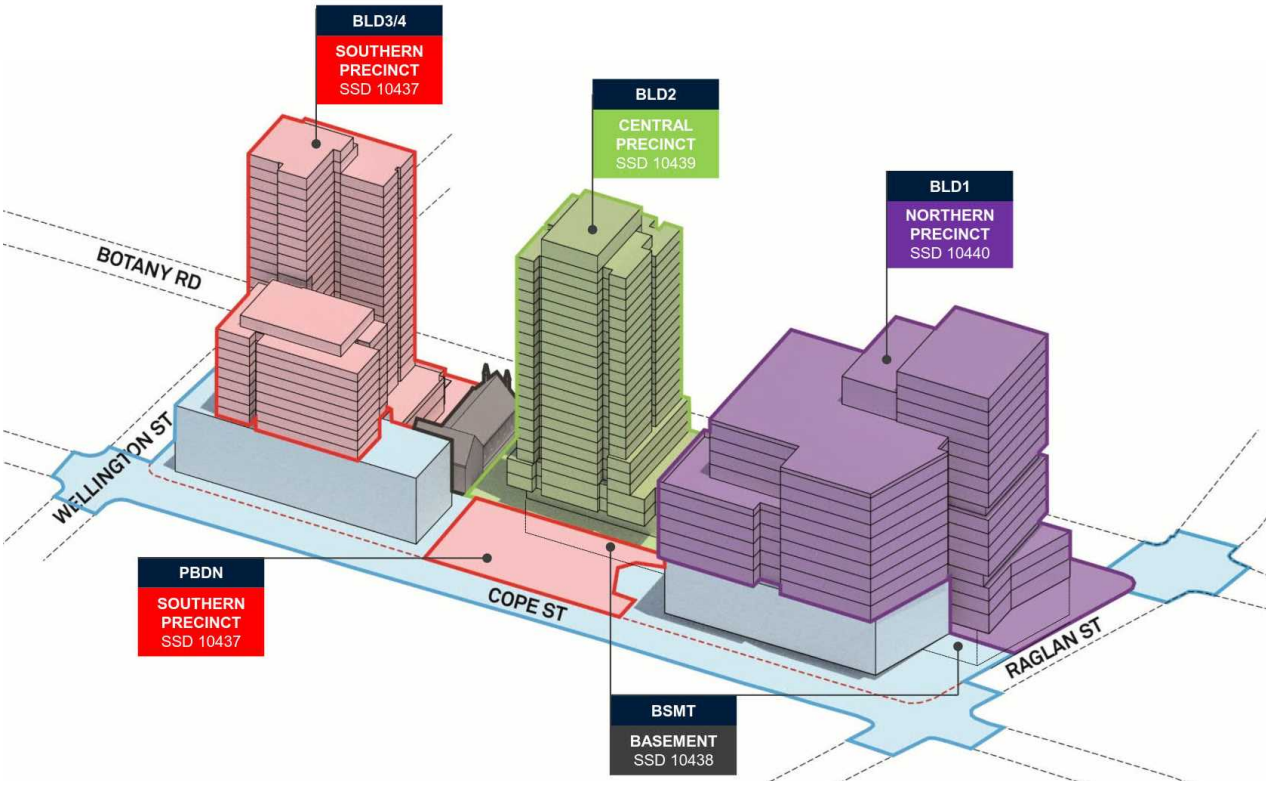


Figure 2- Waterloo Metro Quarter site, with sub-precincts identified

Source: HASSELL

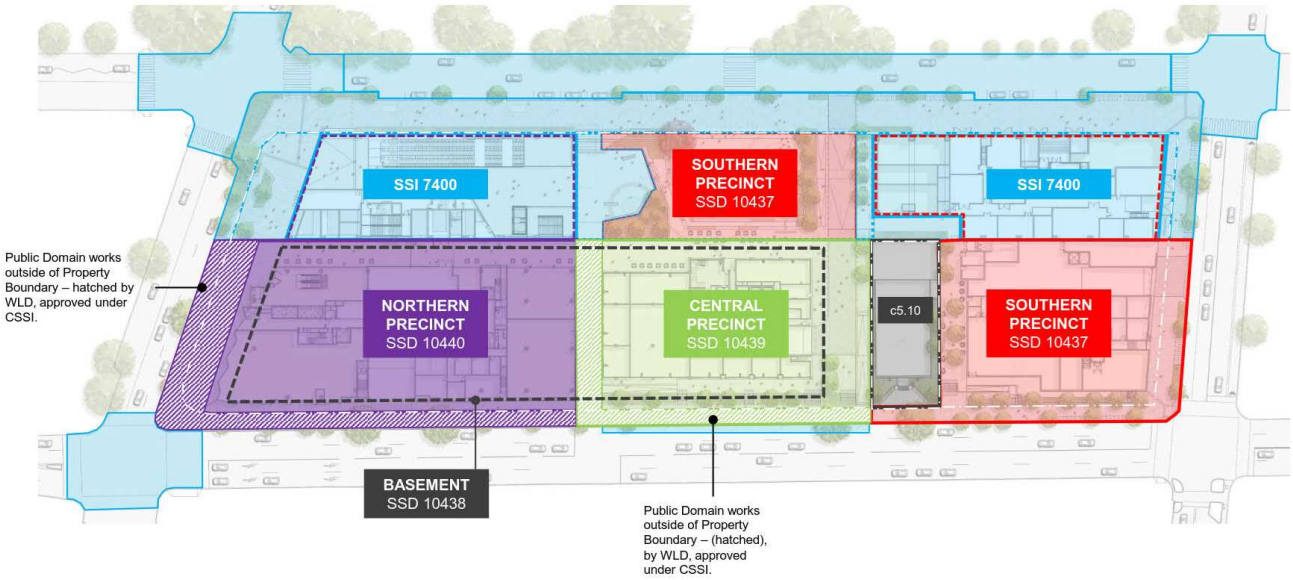


Figure 3- Waterloo Metro Quarter site, with sub-precincts identified

Source: Waterloo Developer Pty Ltd

2.2 Nearest potentially affected noise receivers

The subject project under study in this report includes the construction of the Southern Precinct as part of the Waterloo Metro Quarter Over Station Development located adjacent to the Waterloo Metro Station.

The site noise investigations are a key piece of information when understanding the existing ambient noise environment characteristic of the surrounding receivers to the proposed development. For the nominated criteria, where the measured results are required as the basis of establishing the criteria, historical site noise investigation results have been used because this more accurate data (pre-covid 19) reflects the ambient noise level for each noise catchment area. We have delineated the various environments into Noise Catchment Areas (NCAs) together with the Integrated Station Development and the other buildings assessed in separated SSDA's within the Waterloo Metro Quarter OSD precinct.

The nearest potentially affected noise receivers have been identified in Table 1 and shown in Figure 1.

Table 1: Summary of noise sensitive receivers

Noise Catchment Area (NCA)	Noise Catchment Area Receivers Description	Receiver ID	Most affected Address from the proposed construction noise works
NCA 01	Commercial and retail receivers	C1	110 Botany Road - 132 Botany Road
	Residential Receivers	R4	47 Botany Road 62-72 Botany Road 128 Botany Road
NCA 02	Various Residential Receivers	R1	209 Cope Street
NCA 03	Various Residential Receivers	R2	219 Cope Street & 123 Wellington Street
		R3	122 Wellington Street – 134 Wellington Street
Waterloo Congregational Church	Place of Worship	W1	103 Botany Road

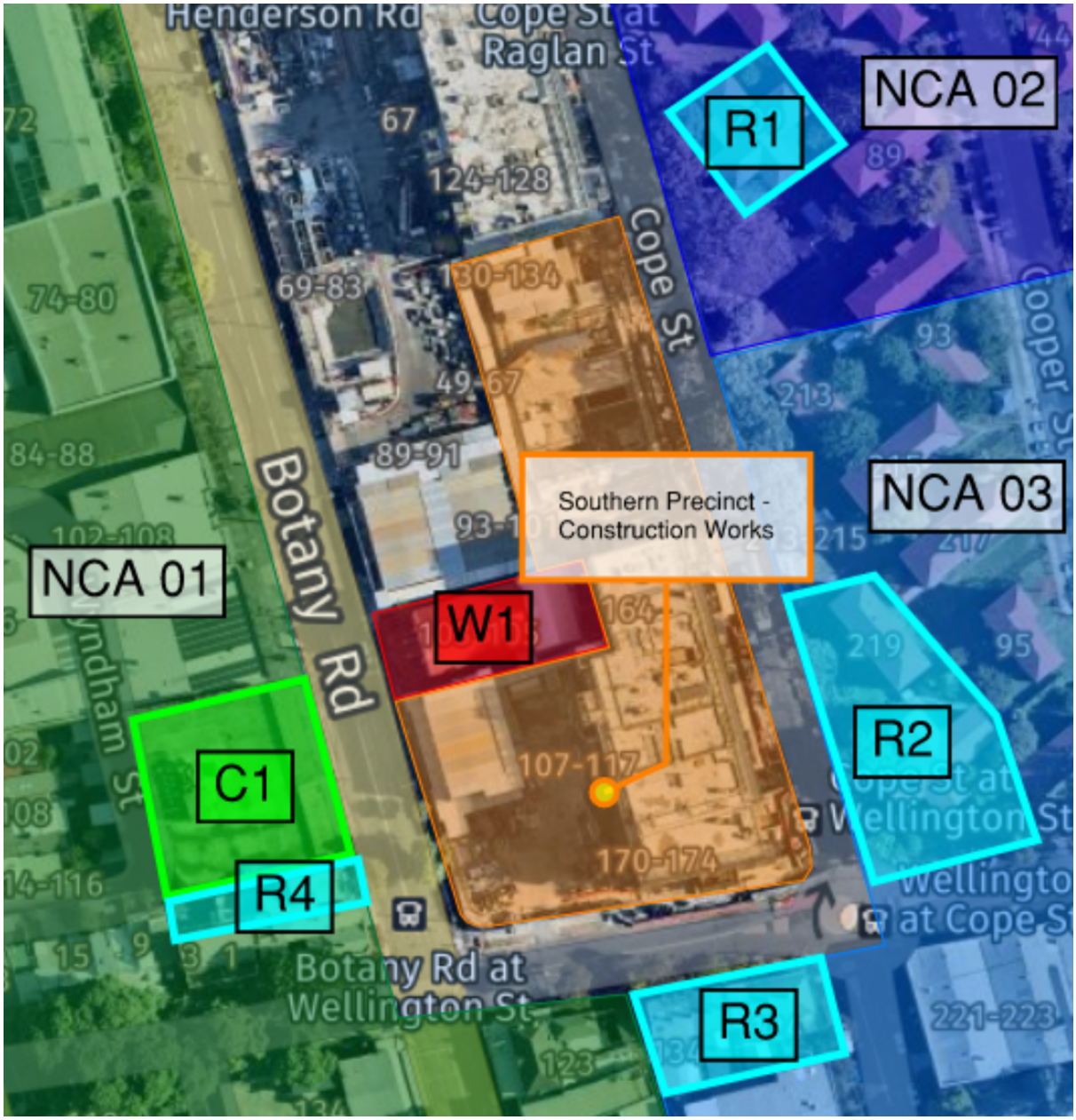


Figure 4: Site and surrounding Noise Catchment Areas for Noise Sensitive Receivers

2.3 Existing Noise & Vibration Environment

The local ambient noise and vibration environment is typically that of an urban/suburban environment, and is dominated by road traffic on Botany Road, which runs along the west of the site (urban). There are other surrounding roads (Wellington Road and Cope Street) which bound the site as well. Additionally, there is currently additional construction works in the vicinity, as well as operation of the nearby commercial and retail developments (i.e. café).

3. Site Noise Investigations

Previous noise monitoring was undertaken during the early works of the project. Site noise investigations were conducted to obtain background noise levels at the surrounding noise sensitive receivers together with characteristic noise emissions statistics associated with vehicle movements along Botany Road.

The results of the site noise investigations were acquired from a combination of noise monitoring conducted by Stantec Australia between the 7th and 13th April 2020, and previous noise monitoring conducted by SLR Consulting and presented in their report for the *Waterloo Station Development EIS*, Appendix N, dated 9 November 2019 accompanying the Concept SSD DA (SSD 9393), as these results were obtained prior to the COVID-19 pandemic and are a better representation of the traffic noise and typical background levels under typical conditions.

3.1.1 Historical Site Noise Investigations

Forming part of the Concept SSD DA (SSD 9393), both attended and unattended site investigations were conducted by SLR Consulting in November 2019, presented in their report for the *Waterloo Station Development EIS*, Appendix N, dated 9 November 2019. The results of these measurements are summarised below. As discussed above, the site investigations previously conducted by SLR Consulting are relevant as the monitoring were conducted prior to the COVID-19 pandemic.

3.1.2 Instrumentation

It is noted in the SLR Consulting Report that the following equipment was used for the noise surveys:

- Combination of Svantek 957 and Brüel and Kjaer 2250L noise loggers with serial numbers:
- S/N:20663
- S/N:3004636
- S/N:3003632
- S/N:3005908
- S/N:3005904
- S/N:3003389
- Brüel and Kjær 2270 Precision Sound Level Meter (S/N:3008204)

SLR consulting also notes:

> *'Calibration of the sound level meter was checked before and after each measurement and the variation in calibration at all locations was found to be within acceptable limits at all times'*

3.1.3 Locations

The locations of noise monitors installed by SLR Consulting referenced in the Waterloo Station Development EIS (Appendix N) dated 9 November 2019 are shown in Figure 5 and listed in Table 2 below:

Table 2 - SLR Consulting long-term noise measurement locations

Noise Monitoring Location ID	Noise Monitoring Location Address	Equipment Serial Number
L1	1 Phillip Street, Waterloo	20663
L2	3 Phillip Street, Waterloo	3004636
L3	200 Pitt Street, Waterloo	3003632
L4	113 Wellington Street, Waterloo	3005908
L5	130 Botany Road, Waterloo	3005904
L6	34 McEvoy Street, Waterloo	3003389

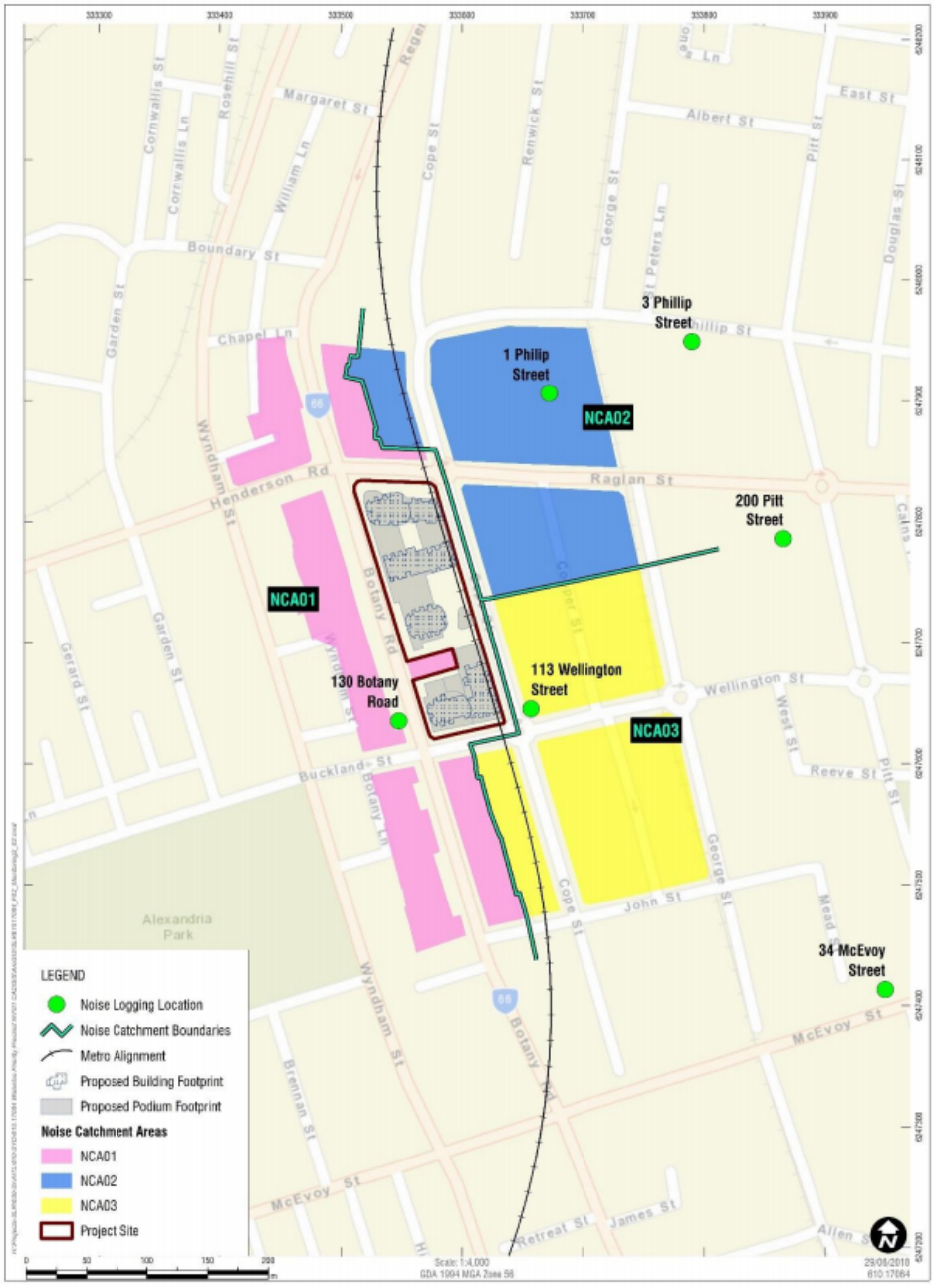


Figure 5 - Measurement locations conducted by SLR Consulting

3.1.4 Long-Term (Unattended) Noise Surveys

Outlined in SLR Consulting report, the results of the unattended ambient surveys are summarised in Table 3 as the Rating Background Level (RBL) noise levels for the Noise Policy for Industry (NPI) daytime, evening and night-time periods, and the L_{Aeq} (equivalent continuous level) noise levels for the DoP Interim Guideline daytime and night-time periods.

The 24-hour daily noise levels at each monitoring location are presented in the State Significant Development (SSD) Development Application (DA) prepared by Stantec, dated 30th September 2020.

Table 3 - Long-term noise measurement summary conducted by SLR Consulting

Noise Monitoring Location	Measured Noise Level (dB)							
	NPI Time Periods[1]						DoP Interim Guideline Time Periods[2]	
	Daytime – RBL	Evening - RBL	Night-time – RBL	Daytime - L_{Aeq}	Evening - L_{Aeq}	Night-time - L_{Aeq}	Daytime - $L_{Aeq(15hr)}$	Night-time - $L_{Aeq(9hr)}$
L1	50	46	40	57	53	50	56	51
L2	48	42	38	57	52	50	56	50
L3	47	43	37	61	58	59	60	59
L4[3]	50	46	41	65	57	54	64	54
L5	60	58	46	72	70	69	72	69
L6[4]	Failed	-	-	-	-	-	-	-

Note 1: Noise Policy for Industry (NPI) assessment periods – Daytime: 7:00 am to 6:00 pm Monday to Saturday, 8:00 am to 6:00 pm Sundays and Public Holidays; Evening: 6:00 pm to 10:00 pm; Night: 10:00 pm to 7:00 am Monday to Saturday, 10:00 pm to 8:00 am Sundays and Public Holidays.

Note 2: DoP Interim Guideline Assessment Time Periods – Day: 7.00 am to 10.00 pm; Night: 10.00 pm to 7.00 am (weekly data).

Note 3: Attended noise measurements at this location identified a bird feeder located on the wall of the residential building. This was not identified at the time the noise logger was deployed as it was raining. At the time of the attended measurements the bird feeder attracted a large number of Rosellas which were generating noise levels over 100 dBA. This significant noise source is the reason that the DoP noise levels for L4 are higher than other comparable noise environment areas of the Waterloo project area.

Note 4: The noise logger at location L6 was damaged during the logging survey and no data was recorded.

3.1.5 Short-Term (Attended) Noise Surveys

Short-term (attended) noise surveys have been conducted by SLR Consulting. The results of these surveys are outlined in Table 4.

Table 4 - Short-term noise measurement summary conducted by SLR Consulting

Measurement Location	Measured Noise Level (dB)[2]			Description of Ambient Noise Source during attended period
	L_{A90}	L_{Aeq}	L_{Amax}	
1 Phillip Street	48	58	75	Constant nature sounds with regular pedestrian movements. Intermittent traffic from Raglan Street and Phillip Street. Aircraft pass-bys are dominant sound source when present.
3 Phillip Street	52	61	85	Constant nature sounds with regular pedestrian movements. Intermittent traffic from Phillip Street. Dominant sound source is landscaping works in the area and aircraft pass-bys when present. It is expected that landscaping noise would not be present during night-time periods.
200 Pitt Street	55	62	81	Intermittent traffic noise from Raglan Street, particularly from vehicles travelling uphill. Landscaping works are dominant sound source during measurement. It is expected that landscaping noise would not be present during night-time periods.
34 McEvoy	58	66	80	Dominant sound source McEvoy Street traffic, with occasional pedestrian activity. Limited aircraft passbys during measurement.
113 Wellington Street	51	63	92	Constant parrot activity during measurement. Intermittent traffic noise from Wellington Road with some aircraft passby noise. Limited pedestrian activity.
130 Botany Road[1]	65	73	88	Traffic noise from Botany Road is dominant sound source, with limited aircraft passby.

Note 1: Monitoring location near to building facade. Measured noise levels considered to represent facade affected noise levels which are up to 2.5 dBA higher than the equivalent free-field condition

Note 2: Measured Noise Level is rounded to the nearest whole number

3.2 Site Noise Investigations

Site noise surveys have been conducted by Stantec to obtain current background noise levels. It should be noted that the site surveys were conducted during the COVID-19 pandemic. Please refer to Section 3.2.1 for further discussion surrounding consideration given to noise monitoring results affected by COVID-19.

Short-term and long-term noise surveys were carried out on and around the proposed development site to characterise the noise generated by nearby traffic noise sources (Botany Rd, Raglan St, and Wellington St), and background and ambient noise representative of the surrounding noise-sensitive receivers.

3.2.1 COVID-19 Pandemic and Effects on Noise Surveys

These noise surveys were carried out under noise-subdued circumstances as a result of the COVID-19 pandemic. For background and ambient noise, the noise statistics obtained will be lower than that of a typical day to day operation and hence can be considered the worst-case scenario.

For the traffic noise measurements, the noise statistics obtained will not be representative of typical traffic noise on Botany Road, Raglan Street, Wellington Street. As a result, the traffic noise measured on-site has been adjusted using comparisons between COVID-19 and standard peak hour traffic volumes on these roads.

3.2.2 Instrumentation

The following equipment was used for the noise surveys:

- ARL Environmental Noise Logger, NL-42EX, S/N 873125
- ARL Environmental Noise Logger, NL-42EX, S/N 521656
- ARL Environmental Noise Logger, NL-42EX, S/N 184109
- ARL Environmental Noise Logger, NL-42EX, S/N 184111
- ARL Environmental Noise Logger, NL-42EX, S/N 885460
- Hand-held sound spectrum analyzer B&K 2250, S/N 2709742;
- Sound Calibrator B&K Type 4231, S/N 2709826;

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

3.2.3 Monitoring Locations

The site location, measurement positions and surrounding noise and vibration sensitive receivers are shown in Figure 6.

Figure 6 - Overview of the site, surrounding noise-sensitive receivers and measurement locations conducted by Stantec Australia

3.2.4 Long-Term (Unattended) Noise Surveys

Background Noise

Noise monitors were placed at position L1 and L5 as shown in Figure 6 measure the background and ambient noise that is representative of the surrounding noise-sensitive receivers. Noise monitors L1 and L5 were installed from the 7th to the 13th of April 2020. The results of the unattended background and ambient noise survey is shown in Table 5 below (for the day, evening and night periods).

Table 5 - Long-term noise survey summary – Background noise (Stantec Australia Monitoring)

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)			Background Noise Level RBL - dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	61	57	50	44	42	36
L5	72	73	67	54	48	41

The local ambient noise environment is dominated by traffic noise from Botany Road throughout the majority of the day, evening and night periods. Note that any rain affected data during the period of logging has been excluded from the calculations. Refer to Figure 7 for the noise data for the total period of measurement.

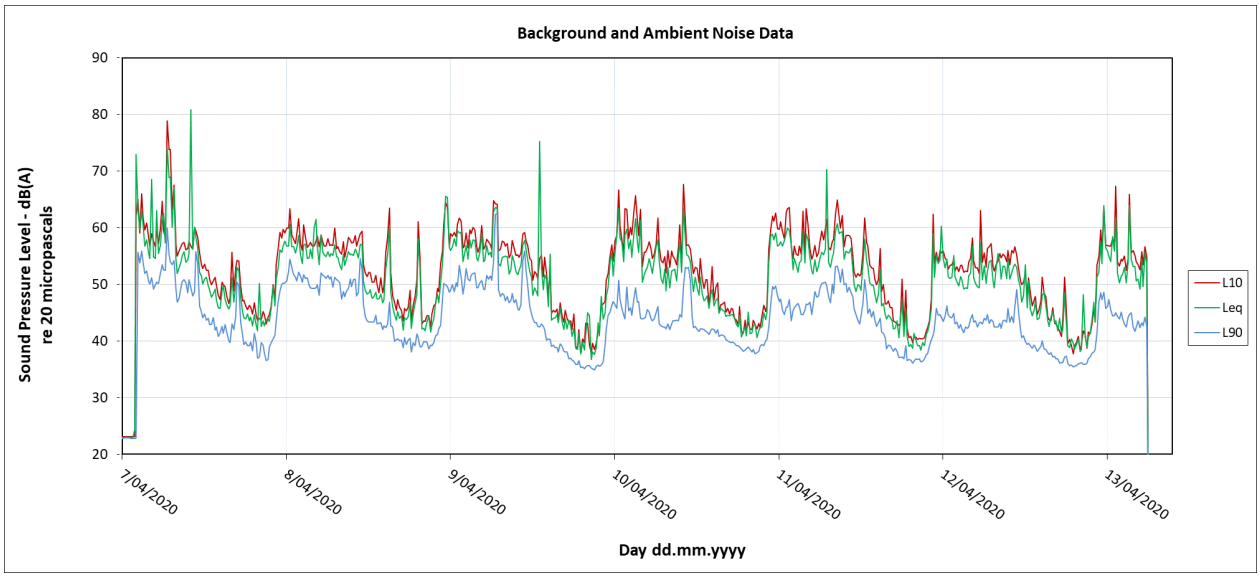


Figure 7 - Long-term background noise monitoring data – L1

3.3 Summary of Noise Investigations

The site noise investigations are a key piece of information when understanding the existing ambient noise environment at the surrounding receivers to the proposed development. For the nominated criteria outlined in Section 4 where the measured results are required as the basis of the criteria, historical site noise investigation results, have been used because this more accurately reflects the ambient noise level for each noise catchment area (historical site noise investigation results were not affected by the COVID-19 pandemic). Stantec delineated the various environments into Noise Catchment Areas (NCAs) together with the Integrated Station Development and the other buildings assessed in separate SSDDAs within the OSD precinct, which is outlined in Figure 8. The summary of the receivers within these catchments include:

- NCA01 - Mix of residential, commercial and retail receivers
- NCA02 - Residential receivers
- NCA03 - Residential receivers
- SSD-10440 – Northern Precinct
- SSD-10439 – Central Precinct
- SSI-7400 – Integrated Station Development
- Waterloo Congregational Church

Figure 8 - Noise Catchment Areas (NCA)

4. Noise & Vibration Criteria

4.1 Construction Noise Criteria

The *Interim Construction Noise Guideline* (ICNG) by NSW DECC recommends the following standard hours of construction:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and public holidays: no work

The noise criteria associated with construction and its related activities are shown in Table 6, as presented in Section 4.1.1 Table 2 of the ICNG.

Table 6: Construction Noise Criteria at Residences

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours:	Noise Affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured **$L_{Aeq,15min}$** is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Outside Recommended Standard Hours	Noise Affected RBL + 5dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2. of the ICNG

Note: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30m away from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Section 4.1.3 of the ICNG sets out the noise management levels for other land uses, including commercial premises and Hospital wards and operating theatres. The internal noise levels should be assessed at the most affected occupied point and the external noise levels are to be assessed at the most affected point within 50 m of the area boundary. However, for other noise-sensitive receivers (e.g. hotels), the guideline recommends the 'maximum' internal noise levels recommended in Australian/New Zealand Standard AS/NZS 2107:2000 *Acoustics—Recommended design sound levels and reverberation times for building interiors* , in determining relevant noise levels.

Based on the criteria in the tables above, the following noise management levels in Table 7 and Table 8 should be applied to the noise sensitive receivers. These criteria apply to airborne noise emissions related to construction activity during the recommended standard hours only. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences. This assumes an open window.

Table 7: Project Specific Construction Noise Management Levels (Standard Hours)

Receiver	NCA	Land Use	Internal noise level criteria	Noise Management Level (external), $L_{Aeq,15min}$	Highly Noise Affected Level, $L_{Aeq,15min}$
C1	NCA 01	Commercial	-	70 dB(A)	N/A
R4	NCA 01	Residential		54 dB(A) + 10 dB = **64 dB(A)**	75 dB(A)
R1	NCA 02	Residential	-	50 dB(A) + 10 dB = **60 dB(A)**	75 dB(A)
R2	NCA 03	Residential	-	47 dB(A) + 10 dB = **57 dB(A)**	75 dB(A)
R3	NCA 03	Residential	-	47 dB(A) + 10 dB = **57 dB(A)**	75 dB(A)
W1	-	Place of Worship	45 dB(A)	55 dB(A)	N/A

Table 8: Project Specific Construction Noise Management Levels (Outside Recommended Standard Hours)

Receiver	Standard Hours (Day) $L_{Aeq,15min}$, dB(A)		Saturday OOH 15:30-18:00 $L_{Aeq,15min}$, dB(A)		Sunday OOHW (Day) $L_{Aeq,15min}$, dB(A)		OOHW (Evening) $L_{Aeq,15min}$, dB(A)		OOHW (Night) $L_{Aeq,15min}$, dB(A)	
	RBL	NML	RBL	NML	RBL	NML	RBL	NML	RBL	NML
NCA 01 (Commercial)	-	70	-	70	-	70	-	70	-	70
NCA 01 (Residential)	54	64	60	65	54	59	48	53	41	46
NCA 02 (Residential)	49	59	50	55	49	54	48	53	40	45
NCA 03 (Residential)	44	54	50	55	44	49	42	47	36	41
Place of Worship	-	45 (internal) 55 (external)		45 (internal) 55 (external		45 (internal) 55 (external)		45 (internal) 55 (external)		45 (internal) 55 (external)

4.2 Sleep Disturbance Criteria

Noise sources of short duration and high level that may cause disturbance to sleep if occurring during the night-time period need to be considered.

The approach recommended by the NPfI is to apply the following initial screening noise levels:

- $L_{Aeq,15min}$ 40dBA or the prevailing RBL + 5dB, whichever is the greater; and/or
- L_{AFmax} 52dBA or the prevailing RBL + 15dB, whichever is the greater.

The sleep disturbance screening noise levels apply outside bedroom windows during the night period. Where the screening noise levels cannot be met, a detailed maximum noise level event assessment should be undertaken. It may also be appropriate to consider other guidelines including the NSW Road Noise Policy (RNP)which contains additional guidance relating to potential sleep disturbance impacts. A summary of the project specific sleep disturbance criteria are shown below in Table 9.

Table 9: Sleep disturbance criteria

Noise Catchment Area (NCA)	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)
NCA 01 (Residential)	46	56
NCA 02	45	55
NCA 03	41	52

4.3 Construction Vibration Criteria

The vibration emitted from construction works should be such that it does not exceed the maximum limits set out in the criteria presented in Table 10 to Table 13.

4.3.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day. The guide on preferred values for human comfort have been extracted from the NSW DEC *Assessing Vibration: A Technical Guideline* (2006). The criteria for continuous and impulsive vibration are summarized in Table 10.

Table 10: Criteria for Exposure to Continuous and Impulsive Vibration

Place	Time	Vibration Acceleration (m/s^2)			
		Preferred		Maximum	
Continuous Vibration		z axis	x and y axis	z axis	x and y axis
Residences	Day- or night-time	0.010 0.007	0.0071 0.005	0.020 0.014	0.014 0.010
Critical areas[1]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Offices, schools, educational	Day- or night-time	0.020	0.014	0.040	0.028
Impulsive Vibration		z axis	x and y axis	z axis	x and y axis
Residences	Day- or night-time	0.30 0.10	0.21 0.071	0.60 0.20	0.42 0.14
Critical areas[1]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Offices, schools, educational	Day- or night-time	0.64	0.46	1.28	0.92

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. The criteria applicable when considering periods of intermittent vibration are presented in Table 11.

Table 11: Acceptable Vibration Dose Values for Intermittent Vibration (1.75 m/s)

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26
Critical areas[1]	0.10	0.20	0.10	0.20
Offices, schools, educational	0.40	0.80	0.40	0.80

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

4.3.2 Structural Damage – Vibration Criteria

Ground vibration criteria are defined in terms of levels of vibration emission from construction activities that will not damage surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity. The human comfort criteria are also often exceeded before a risk of structural damage.

Structural damage criteria are presented in German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures* and British Standard BS 7385-2:1993 *Evaluation and Measurement for Vibration in Buildings*. The British Standard BS 7385-2:1993 establishes vibration values for buildings based on the lowest vibration levels above which damage has been credibly demonstrated. These values are evaluated to give a minimum risk of vibration-induced damage, where the minimal risk for a named effect is usually taken as 95% probability of no effect. The aforementioned values are summarised in Table 12 and Table 13.

Table 12: Transient Vibration Guide Values for Cosmetic Damage – BS 7385-2:1993

Type of Building	Peak component particle velocity in frequency range of predominant pulse		
	Transient vibration sources		Intermittent vibration sources*
	4 Hz to 15 Hz	15 Hz and above	All frequencies
Reinforced or framed structures (Industrial or light commercial type buildings)	50 mm/s		25 mm/s
Unreinforced or light framed structures (Residential or light commercial type buildings)	15 mm/s	20 mm/s (50 mm/s at 40Hz and above)	7.5

Note: 1) For construction activities involving intermittent vibration sources (i.e. rock breakers, piling rigs, vibratory rollers, excavators), that may rise to resonant responses in structures and to low-rise buildings, guide values in Table 12 may need to be reduced by up to 50% as a conservative vibration damage screening levels.

Table 13 indicates the vibration limits presented in DIN 4150-Part 3 to ensure structural damage does not occur.

Table 13: Guideline Value of Vibration Velocity (V_i) for Evaluating Effects of Short-Term Vibration – DIN 4150-Part 3

Line	Type of Structure	Vibration velocity, v_i, in mm/s				Long-term vibration[2]
		At the Foundation At a frequency of			At the Plane of floor of highest floor	At the Plane of floor of highest floor
		Less than 10Hz	10 to 50Hz	50 to 100Hz [1]	All Frequencies	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	All Frequencies	40	10
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15	5
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value	3	3 to 8	8 to 10	8	2.5

	(e.g. buildings that are under a preservation order)					

Note: 1) For frequencies above 100Hz, at least the values specified in this column shall be applied.
2) All types of vibration that may cause structural fatigue and which may produce resonance

4.3.3 Heritage Items

Figure 9 and Table 14 presents the location of the heritage buildings closest to the Waterloo Metro development as outlined within NSW Heritage Inventory Register.

Figure 9: Location of heritage significant buildings

Table 14: Details of heritage significant buildings (NSW Heritage Inventory Register)

Ref	Location	Current Use	Integrity	Proposed Vibration Criteria
H1	Lord Raglan Hotel, 12 Henderson Road	Commercial	Mixed	DIN 4150-Part 3 – Line 3
H2	Former CBC Bank, 60 Botany Road	Commercial	Unknown	
H3	Cricketers Arms Hotel, 56-58 Botany Road	Residential and Commercial	Externally intact	
H4	Waterloo Congregational Church, 103-105 Botany Road	Church	Structurally sound	DIN 4150-Part 3 – Line 2

H5	Cauliflower Hotel, 123 Botany Road	Commercial	Externally intact	DIN 4150-Part 3 – Line 3
H6	Cluster of terraces along Wellington Street	Residential	Unknown	
H7	Former Waterloo Pre-school, 225 Cope St	Residential	Relatively intact	

5. Construction Noise Assessment

5.1 Proposed Construction Activities

The constructible plan and staging detailing the extent of work, time frames of stages, expected equipment and proposed locations of equipment has been provided by John Holland. Concurrent works have been grouped together and separated into stages for the purposes of the acoustic assessment. For the purpose of this assessment, the noise impact from the following anticipated general construction works is considered:

- Stage 1: Tree Removal (completed)
  - Tree Removal – Chainsaw and Mulcher – one day of work expected
- Stage 2: Remediation and retaining wall works
  - Concrete hardstand removal for remediation (completed)
  - Ground Preparation for retaining walls
  - Retaining Wall to Botany St and Church
- Stage 3: Piling works (complete)
  - Drilling Bored Piles (within 5m of station box)
- Stage 4: Additional piling and concurrent demolition works (completed)
  - Concrete hardstand removal for pile caps and bases
  - Pile cropping (within 5m of station)
  - Station capping beam and shoring wall demolished
  - Drilling bored piles (remaining)
- Stage 5: Excavation (completed)
  - Pile Cropping (remaining)
  - Drilling Bored Piles (remaining)
  - Sheet Piling
  - Excavation for core bases and pile caps
  - FRP bases
  - Backfill and compact
  - Detailed excavation
  - FRP Pile caps
- Stage 6: Structure
  - Building 3 Slabs and verticals
  - Building 4 Slabs and verticals
  - Jumpform 3

- Jumpform 4
- Building 3 Façade works
- Building 4 Façade works

- Stage 7 – Fitout and landscaping works

Out-of-Hours Works (Refer to OOH CNVIA 'WMQ-46198-STA-AC-RE-CNVIA-OOH-007 dated 15/05/2024)

- Stage 1: Deliveries, Materials handling, Office areas, Storage areas, Car parking.
- Stage 2: Formwork, Concrete pours, Structural steel.
- Stage 3: Internal fit out and finishes.

The construction layouts and plans have been outlined in Appendix B.

5.2 Construction Hours

5.2.1 Standard Hours – Interim Construction Noise Guideline

The hours of work are expected to occur during '*Standard Hours'* as per ICNG:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and public holidays: no work

5.2.2 Approved Hours – Modification of Development Consent (SSD-10437-MOD-3)

D3. Construction, including the delivery of materials to and from the site, may only be carried out between the following hours:
  (a) between 7am and 6pm, Mondays to Fridays inclusive; and
  (b) between 7:30am and 6pm, Saturdays.

D4. Except as permitted in Condition D5, no work may be carried out on Sundays or public holidays

D5. Work/activities may be undertaken outside of the hours specified in Condition D3 and D4 under the following circumstances:
  (a) If required by the Police or a public authority for the delivery or removal of vehicles, plant or materials, or installation and dismantling of plant or equipment; or
  (b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm, or
  (c) if a relevant utility service operator has advised the Applicant in writing that carrying out the works and activities would result in a high risk to the operation and integrity of the utility network, or
  (d) concrete pours or finishing works may finish after 6pm and no later than 10pm Monday to Friday on a maximum of two occasions per calendar month, or
  (e) hoist and crane climbing or dismantling between 8am and 5pm on Sunday for a maximum of two Sundays over the duration of the project where it can be demonstrated that the work cannot be undertaken during the standard construction hours in Condition D3, or
  (f) internal fit-out and services installation/commissioning up to 24 hours a day (excluding Sundays and public holidays) behind a closed facade capable of achieving a minimum of 30dB(A) noise reduction from the equipment used and subject to the use of the goods lift only.

D6. Activities permitted in Condition D5 are subject to the following:

(a) Notification of such activities must be given to affected receivers before undertaking the activities or as soon as is practical afterwards.

(b) Prior written agreement must be obtained from the owners/operators/administration of the Waterloo Congregational Church, including provisions for:

(i) scheduling noisy activities during times that are outside of church services

(ii) direct contact information for site foreperson for any concerns or complaints that arise during extended construction hours

(iii) implementation of adjustments, including consideration of ceasing works, to construction methodologies and/or implementation of additional noise and vibration control measures to accommodate the Church's needs

(c) Should noise complaint(s) be received and the complaint(s) be confirmed as connected with a non-compliance with Condition D5 and/or D6 after being substantiated by the Department's Compliance Team, the construction work occurring during extended construction hours in Condition D5 above must cease and may not recommence until:-

(i) compliance with the conditions of consent has been established;

(ii) compliance with the relevant noise management and mitigation measures identified in the Construction Noise and Vibration Management Sub-Plan (CNVMP) prepared under Condition C22 has been established; and

(iii) it can be satisfactorily demonstrated to the Planning Secretary that any additional management and mitigation measures, as recommended by a qualified acoustic consultant, have been fully implemented.

(d) The Planning Secretary may suspend the works within the extended hours under Condition D5 if substantiated complaints are received and are not resolved to the satisfaction of the Planning Secretary.

D7. Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:

(e) 9am to midday, Monday to Friday;

(f) 2 pm to 5pm Monday to Friday; and

(g) 9am to midday, Saturday.

5.3 Construction Noise Evaluation Scenarios

Noise levels for each stage of the construction works are predicted and evaluated based on the following scenarios:

Worst-case: in this scenario, some of the noisiest equipment is assumed to be operating towards the boundary of the construction site (closest distance to a receiver).

Average-case: in this scenario, most of the equipment are assumed to be operating towards the middle of the site. This scenario is expected to represent the average noise expected from the entire site at a receiver and expected to be representative of the longer-term average noise emissions. It is noted that a receiver is not expected to be consistently exposed to the Average-case noise levels due to the transient nature of construction noise where construction activity moves around the site. This situation represents typical average construction noise emissions.

5.4 Expected Construction Equipment

The noise sources likely to be associated with the proposed works and the assumed operating duty rates for each equipment item are presented in Table 15. All plant and equipment sound power levels have been extracted from:

- AS 2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites;
- AS 2436:1981 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.

Table 15: Construction Equipment Sound Power Levels (Standard Hours)

Stages	Equipment	Sound Power Level – dB(A)	Average-case		Worst-case	
			Quantity	Usage in 15-minute (% Time)	Quantity	Usage in 15-minute (% Time)
Remediation and retaining wall work	15t Excavator breaker	124[2]	-	-	1	50
	15t Excavator with bucket	107	1	25	-	-
	Pad Compactor	115	1	25	-	-
	Concrete Pump	110	1	25	-	-
	Road Saw	127[2]	-	-	1	25
Tree Removal	Chainsaw	119[2]	1	50	1	50
	Mulcher	118	1	50	1	50
Piling	Piling Rig Bored	116	2	25	2	75
	Concrete Pump	110	2	25	1	50
	Diesel Crane	111	1	25	1	40
Piling and concurrent demolition works	15t excavator with bucket	107	1	25	1	50
	Piling Rig Bored	116	2	40	-	-
	Sheet Piling (vibratory piling) / Road Saw[1]	125/ 127[2]	-	-	1	50/ 25
	Concrete Pump	110	2	40	-	-
	Diesel crane	111	1	25	-	-

Stages	Equipment	Sound Power Level – dB(A)	Average-case		Worst-case	
			Quantity	Usage in 15-minute (% Time)	Quantity	Usage in 15-minute (% Time)
Excavation	15t excavator with bucket	107	1	50	1	75
	Concrete Pump	110	1	25	1	50
	Piling Rig Bored	116	1	40	-	-
	Pad compactor	115	-	-	1	25
	Vibratory Roller	112	-	-	1	25
	Hand Tools	102	2	50	1	75
Structure	Concrete Pump	110	1	25	2	25
	Diesel crane	111	1	25	1	40
	Hand Tools	102	1	50	2	75
	Electric Crane	105	1	25	1	40
	Single/Twin Car Hoist	68	1	25	1	25

Note 1: Only one is expected to operate at any given time.

Note 2: A +5 dB correction factor has been included in accordance with recommendations given in Section 4.5 of the ICNG

Table 16: Construction Equipment Sound Power Levels (OOHW)

Activity/ Work Area	Plant/ Equipment	Saturday 3.30pm-6pm	Evening 6pm - 10pm	Night 10pm - 6am	Sound Power Level (Lw re: 1pW) dB(A) L_{Aeq}	Duration in a 15min period, %
Extended Saturday Works (3:30pm-6pm)	Concrete Pump	1	-	-	110	25
	12t Tower Crane	1	-	-	87	25
	Single Hoist	1	-	-	96	25
	Mechanical trowel	2			98	50
	Power hand tools	7	-	-	102	50
	Forklift	1	-	-	99	50
Stage 3 - Internal fit-out	Power hand tools	-	5	5	108	50
	Forklift (Groundfloor/Street level)	-	1	1	99	50
	EWP	-	4	4	95	50
	Single Hoist	-	1	1	97	75

Table 17: Construction Equipment Sound Power Levels (OOHW & Limited Occurrences)

Activity/ Work Area	Plant/ Equipment	Sunday 7am -6pm	Evening 6pm -10pm	Sound Power Level (Lw re: 1pW) dB(A) L_{Aeq}	Duration in a 15min period, %
Stage 1 - Compound general activities	Delivery trucks	4 per hour	-	108	25
	Light vehicle	2 in/ out	-	90	25
	400T Mobile Crane	1		113	-
	12t Electric Tower Crane	-	1	87	-
	Single Hoist	1	1	96	75
	Forklift	1	1	98	75
Stage 2 - Structure construction (steel/formwork/concrete)	Concrete placement booms	-	1	93	50
	Static concrete pump	-	1	103	75
	Concrete agitator trucks	-	3 per hour	108	75
	Compressor	-	1	102	50
	Mechanical trowel	-	2	102	50

5.5 Noise Prediction Model

The following assumptions were made and applied to the spreadsheet noise prediction model:

- The height of the receivers has been assumed as 1.5m from ground level at the boundary of the residential receivers and most affected façade of other sensitive receivers;
- The predicted noise levels at the nearby sensitive receivers have been assessed with the acoustic recommendations as shown in Section 8.1.1 implemented.
- The effect of other mitigation measures (e.g. respite periods, flex shield barriers to any scaffolding which may be present) has not been included within the model;
- The predicted noise levels have been assessed using neutral weather conditions;
- Sound power levels and the operating duty rates used in the predictions are provided in Table 15.

5.6 Construction Noise Level Prediction Results

The predicted construction noise levels at the closest receiver within each NCA have been presented in Table 18 to Table 23. For assessment purposes, the Evaluation Scenarios, 'Worst-case' and 'Average-case', are also presented.

Table 18: Predicted Noise Levels – Stage 1: Tree Removal

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
R2	Residential	71	84	57	14	27	75	Yes*	No
R3	Residential	77	83	57	20	26	75	No	No
R1	Residential	65	72	60	5	12	75	Yes*	Yes*
R4	Residential	72	85	64	8	21	75	Yes*	No
C1	Commercial	72	85	70	2	15	75	Yes*	No
W1	Place of Worship	80	83	55	25	28	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 19: Predicted Noise Levels – Stage 2: Remediation and Retaining wall works

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
R2	Residential	64	77	57	7	20	75	Yes*	No
R3	Residential	73	81	57	16	24	75	Yes*	No
R4	Residential	66	80	64	2	16	75	Yes*	No
R1	Residential	56	70	60	-	10	75	Yes	Yes*
C1	Commercial	66	80	70	-	10	75	Yes	No
W1	Place of Worship	78	94	55	23	39	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 20: Predicted Noise Levels – Stage 3: Piling

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
R2	Residential	69	73	57	12	16	75	Yes*	Yes*
R3	Residential	77	78	57	20	21	75	No	No
R4	Residential	72	75	64	8	11	75	Yes*	Yes*
R1	Residential	61	65	60	1	5	75	Yes*	Yes*
C1	Commercial	72	75	70	2	5	75	Yes*	No
W1	Place of Worship	84	89	55	29	34	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 21: Predicted Noise Levels – Stage 4: Piling and concurrent demolition works

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
R2	Residential	71	74	57	14	17	75	Yes*	Yes*
R3	Residential	78	76	57	21	19	75	No	No
R4	Residential	73	77	64	9	13	75	Yes	No
R1	Residential	64	68	60	4	8	75	Yes*	Yes*
C1	Commercial	73	77	70	3	7	75	Yes*	No
W1	Place of Worship	86	92	55	31	37	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 22: Predicted Noise Levels – Stage 5: Excavation

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria LAeq	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
R2	Residential	67	75	57	10	18	75	Yes*	No
R3	Residential	73	82	57	16	25	75	Yes*	No
R4	Residential	69	79	64	5	15	75	Yes*	No
R1	Residential	60	69	60	-	9	75	Yes	Yes*
C1	Commercial	69	79	70	-	9	75	Yes	No
W1	Place of Worship	84	91	55	29	36	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 23: Predicted Noise Levels – Stage 6: Structure

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria LAeq	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
R2	Residential	67	70	57	10	13	75	Yes*	Yes*
R3	Residential	75	80	57	18	23	75	Yes*	No
R4	Residential	70	73	64	6	9	75	Yes*	Yes*
R1	Residential	57	60	60	-	-	75	Yes	Yes
C1	Commercial	70	73	70	0	3	75	Yes	Yes*
W1	Place of Worship	74	76	55	19	21	75	Yes*	No

* Complies with highly noise affected criteria although exceeding the relevant NML

5.6.1 Construction Noise Level Prediction Results (OOHW)

Saturday

The noise impact due to extended structure works completed on Saturdays is predicted to be negligible. Table 24 below presents a summary of the noise impact results.

Table 24: Predicted Noise Levels – Saturday 3:30pm-6pm

Precinct (Refer to Figure 1)	ID	Noise Management Level	Predicted Noise Level dB(A)	Exceedance dB(A)	Compliance[2]	
					Average-Case	Worst-Case
Southern	NCA 01 (Commercial)	70	57	-	Yes	Yes
	NCA 01 (Residential)	65	57	-	Yes	Yes
	NCA 02	55	52	2	Yes[1]	Yes[1]
	NCA 03	55	55	-	Yes	Yes
	Church	45	57	12	No	No
Basement	NCA 01 (Commercial)	70	57	-	Yes	Yes
	NCA 01 (Residential)	65	57	-	Yes	Yes
	NCA 02	55	56	1	Yes[1]	Yes[1]
	NCA 03	55	45	-	Yes	Yes
	Church	45	49	4	No	No

1. An exceedance of 1-2 dB is considered negligible as changes in loudness of 2dB are almost imperceivable to human hearing. These noise levels are therefore acceptable.
2. Dominant noise sources are relatively stationary, with minimal fluctuations in noise levels. Worst-case conditions are therefore also representative of the average case.

Sunday - Hoist And Crane Climbing or Dismantling (Maximum of 2 Occurrences for Project Life)

It is noted that out of hours works on Sundays will only occur on a maximum of two Sundays over the duration of the project for the dismantling of tower cranes. No works are intended to be completed on Sundays outside of these two occasions. The noise impact to sensitive receivers from these works is therefore considered to be relatively low, with ample opportunity for notice and management strategies to be implemented prior to works. Table 25 below presents a summary of the noise levels resulting from these works.

Table 25: Predicted Noise Levels – Day OOHW (Sunday)

Precinct (Refer to Figure 1)	ID	Noise Management Level	Predicted Noise Level dB(A)	Exceedance dB(A)	Compliance[2]	
			Stage 1	Stage 1	Average-Case	Worst-Case
Southern	NCA 01 (Commercial)	70	54	-	Yes	Yes
	NCA 01 (Residential)	59	54	-	Yes	Yes
	NCA 02	54	63	9	No	No
	NCA 03	49	63	14	No	No
	Church	45	63	18	No	No
Basement	NCA 01 (Commercial)	70	59	-	Yes	Yes
	NCA 01 (Residential)	59	59	-	Yes	Yes
	NCA 02	54	59	5	No	No
	NCA 03	49	58	9	No	No
	Church	45	60	15	No	No

1. An exceedance of 1-2 dB is considered negligible as changes in loudness of 2dB are almost imperceivable to human hearing. These noise levels are therefore acceptable.
2. Dominant noise sources are relatively stationary, with minimal fluctuations in noise levels. Worst-case conditions are therefore also representative of the average case.

Sunday – All other Occasions

No works are intended to be completed on Sundays outside of the two occasions allowed for to climb and dismantle cranes. Sunday noise levels are therefore expected to be compliant during all other periods.

Evening – Concrete Works (Maximum 2-Per Month - As required)

Evening concrete works are expected to occur irregularly. These works will only occur during the evening period in the event that concrete pours are delayed due to either delivery delays, condition of the concrete etc.

Table 26: Predicted Noise Levels – Evening OOHW

Precinct (Refer to Figure 1)	ID	Noise Management Level	Predicted Noise Level dB(A)			Exceedance dB(A)			Compliance[2]	
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Average Case	Worst Case
Southern	NCA 01 (Commercial)	70	50	53	34	-	-	-	Yes	Yes
	NCA 01 (Residential)	53	50	53	34	-	-	-	Yes	Yes
	NCA 02	53	58	49	35	5	-	-	No[3]	No[3]
	NCA 03	47	58	54	35	11	7	-	No[3]	No[3]
	Church	45	62	61	42	17	16	-	No[3]	No[3]
Basement	NCA 01 (Commercial)	70	50	53	34	-	-	-	Yes	Yes
	NCA 01 (Residential)	53	50	53	34	-	-	-	Yes	Yes
	NCA 02	53	50	53	34	-	-	-	Yes	Yes
	NCA 03	47	50	38	34	3	-	-	No[3]	No[3]
	Church	45	55	54	35	10	9	-	No[3]	No[3]

1. An exceedance of 1-2 dB is considered negligible as changes in loudness of 2dB are almost imperceivable to human hearing. These noise levels are therefore acceptable.
2. Dominant noise sources are relatively stationary, with minimal fluctuations in noise levels. Worst-case conditions are therefore also representative of the average case.
3. Non-compliance only relevant for certain stages

Night Works – Internal Fit Out

Night works are proposed to be completed during the internal fit out and finishes stage behind closed facade. Due to the significant noise reduction provided by the building envelope, the predicted noise impact to the surrounding environment is below the criteria.

It is recommended that the goods and services lift is implemented during night works instead of hoists. With this modification, noise levels during the proposed out of hours night works are predicted to be within compliance. Table 27 presents the predicted noise impact without the use of the single hoist.

Table 27: Predicted Noise Levels – Night OOHW

Precinct (Refer to Figure 1)	ID	Noise Management Level	Predicted Noise Level dB(A)	Exceedance dB(A)	Compliance**	
			Stage 3	Stage 3	Average-Case	Worst-Case
Southern	NCA 01 (Commercial)	70	33	-	Yes	Yes
	NCA 01 (Residential)	46	33	-	Yes	Yes
	NCA 02	45	34	-	Yes	Yes
	NCA 03	41	34	-	Yes	Yes
	Church	45	42	-	Yes	Yes
Basement	NCA 01 (Commercial)	70	33	-	Yes	Yes
	NCA 01 (Residential)	46	33	-	Yes	Yes
	NCA 02	45	33	-	Yes	Yes
	NCA 03	41	33	-	Yes	Yes
	Church	45	34	-	Yes	Yes

Noise sources of short duration and high level that may cause disturbance to sleep if occurring during the night-time period need to be considered. The noise levels due to night works have been compared against the relevant sleep disturbance criteria as detailed in Section 4.2 of this report.

Table 28: Predicted Noise Levels – Sleep disturbance during night time

Precinct (Refer to Figure 1)	ID	Screening Criteria		Predicted Noise Levels for Stages 3 & 4		Complies
		LAFmax	LAeq,15min	LAFmax	LAeq,15min	
Southern	NCA 01	56	46	43	33	Yes
	NCA 02	55	45	44	34	Yes
	NCA 03	52	41	44	34	Yes
Basement	NCA 01	56	46	38	33	Yes
	NCA 02	55	45	32	37	Yes
	NCA 03	52	41	32	33	Yes

5.6.2 Discussion and Assessment (standard hours)

Based on the results of this assessment, the following conclusions are made:

- Noise levels are predicted to exceed the Highly Noise Affected criteria (75 dBA) during all the assumed stages of work at the nearest identified receivers for both average- and worst-case scenarios. Except in the case of the structure stage where the Average-Case is expected to demonstrate compliance across all the adjacent receivers. However, exceedance is still expected during the worst-case scenario.
- ICNG does not set out the Highly Noise Affected Criteria for non-residential receivers. Nevertheless, it should be noted that noise levels are predicted to exceed the Highly Noise Affected criteria (75 dBA) during many of the proposed stages of works at the nearest identified non-residential (i.e. commercial, retail and places of worship) receivers for both average- and worst-case scenarios.
- Noise levels are predicted to exceed the NML during all the assumed stages of work at the nearest identified receivers for various works during both average- and worst-case scenarios.
- Noise levels during all the assumed stages of work are expected to exceed the Noise Management Level by up to 31 dB during the average noise emissions; and up to 37 dB during the Worst-Case assessment scenario for the adjacent Waterloo Congregational Church;
- Noise levels during all the assumed stages of work are expected to exceed the Noise Management Level by up to 21 dB during the average noise emissions; and up to 25 dB during the Worst-Case assessment scenario for the nearby residential receivers;
- Noise levels do demonstrate higher noise levels of up to 84dB (Worst-case – closest boundary to residential receivers) during the tree removal at residential receivers. However, these works are expected to be short-term and will take place over one day early in the works and is expected to not have any prolonged impact.
- Highest noise levels are produced during the use of concrete/road saws and Excavators with breaker attachments;

Based on the above, the proposed construction works have the potential to give rise to adverse noise impacts at identified non-residential receivers. Therefore, all reasonable and feasible measures should be applied on site to assist in reducing the overall noise emissions on site, as per the recommendations in Section 8. It is noted, however, the Average-case scenario is expected to represent the average noise expected from the entire site at a receiver and expected to representative of the longer-term average noise emissions. Therefore, this situation represents typical average construction noise emissions which are predicted to be below the Highly Noise Affected criterion at the nearest identified residential receivers in most instances (R3 being the most affected residential receiver, with occasional minor exceedances of the established criteria).

5.6.3 Discussion and Assessment (Extended Hours)

Based on the results of this assessment, the following conclusions are made:

- The extension of standard Saturday hours will cause a 1-2 dB noise exceedance to nearby residential receivers. An exceedance of 1-2 dB is considered negligible as changes in loudness of ≤2dB are near imperceivable to human hearing. These noise levels are therefore acceptable.
- Noise levels are predicted to exceed the relevant criteria at residential receivers for OOHW for some stages of work at the defined NCAs, with the most impact during Day and Evening OOHW.
- During the Stage 1, the highest noise levels are expected to be generated by tower cranes. Noise levels during this stage are expected to exceed the criteria between 3 to 18 dB(A) during various OOHW. The use of the tower cranes during OOHW are to be limited to where necessary.
- Various noise exceedances are noted for the Waterloo Congregational Church. Consultation with the church has been completed and they have agreed to the proposed extended hours. On going consultation will occur during construction.
- During the Stage 2 works, the highest noise levels are expected to be generated by concrete pump and agitator trucks. Noise levels during this stage are expected to exceed the criteria by up to 16 dB(A) during various OOHW.
- The night-time works for Stages 3 are expected to be compliant with the Noise Management Level criteria
- In addition to above the night-time works for Stages 3 are expected to be below the sleep disturbance criteria. Further discussion has been provided below.
- The exceedance caused by the proposed OOHW are infrequent activities with limited frequency, e.g. crane works are limited to two occurrences throughout the project cycle.

Based on the above, the proposed construction works some works exceed the nominated noise criteria. Therefore, all reasonable and feasible measures should be applied on site to assist in reducing the overall noise emissions on site, as per the recommendations in Section 8. It is noted however, the worst-case scenarios have been assessed. Therefore, we anticipate that generally the noise levels will be significantly lower than those presented.

To substantiate the noise assessment, additional noise monitoring has been proposed as shown in Section 8.6.2.

6. Construction Traffic Noise Generation

Construction traffic movement prediction data is not available and the ICNG does not specify construction traffic noise criteria. However, based on the existing noise levels during the Day period, a typical heavy vehicle movement of four trucks per hour is assumed. On this basis, the construction traffic noise is unlikely to increase the existing traffic noise levels on surrounding roads by 2dB, as per the 'Relative Increase' limit imposed by the NSW Road Noise Policy. As an indication a 3dB increase would represent a doubling of traffic in the area.

7. Construction Vibration Assessment

7.1 Safe Working Distances

The following vibration intensive plant that are assumed for this project are assessed in this Section:

- 15t Excavator - with hammer
- 15t Excavator - with bucket
- Bored piling
- Sheet Piling
- 10T Roller - Vibratory

Indicative recommended 'Safe working' distances for the above vibration intensive plant boundaries are provided in Table 29. At distances beyond the Safe working distances, the recommended targets provided in Table 29 are unlikely to be exceeded.

Table 29: Recommended Safe Working distances for vibration intensive plant

Plant Item	Safe Working Distance (meters)			
	Cosmetic Damage - BS 7385		Cosmetic Damage - DIN 4150	Human Response (OH&E Vibration Guideline)
	Reinforced structures	Un-reinforced structures	Sensitivity to vibration structures	
15t Excavator with hammer	5	10	15	23
15t Excavator with bucket	5	5	5	10
Bored piling	5	5	10	N/A
Sheet Piling	15	20	50	20
10T Roller - Vibratory	10	19	30	100
10T Roller - Static	N/A	N/A	N/A	N/A

Note: When evaluating human response to intermittent vibration, the accumulated vibration energy over the course of day and night periods at the receiver location must be taken into account. As a result, the Safe working distances listed in Table 29 for Human Response, are influenced by the length of vibration exposure. Therefore, if a receiver within these safe working distances is subjected to strong vibration levels for most of the Day/Night period, the recommended vibration targets may exceed and potentially cause complaints.

The piling and excavation activities for the basement are programmed to be complete before the Metro Station is open to the public and therefore, human comfort vibration impact is not considered further.

7.2 Vibration Sensitive Receivers Closer than the Safe Working Distances

At receivers closer than the recommended 'Safe Working' a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure is needed to determine the applicable safe vibration level. Additionally, site measurements and alternative equipment or methodologies, should be considered.

7.2.1 Cosmetic damage

It is noted that there are no unsound structures currently identified. On this basis, no structure near the site falls into the category of ‘Sensitivity to vibration structures’ in Table 29.

The adjacent Waterloo Congregational Church is identified as a heritage listed item. An assessment undertaken by a structural engineer confirms that the church is in Sound Structural condition (see Appendix C). On this basis the screening vibration levels for un-reinforced structures are adopted as per discussion in Section 4.3.3.

The Waterloo Metro Station Box sits either side of the Cope Street Plaza and is considered a reinforced industrial structure and therefore, at low risk from cosmetic or structural damage. There may be occasions where high vibration generating activities, such as sheet piling, 10T Roller – vibratory and excavation using rock hammer attachments are proposed to take place within the ‘Safe Working Distance’ shown in column 1 of Table 29. When this occurs attended vibration monitoring should take place by a qualified acoustic consultant and the structure should be checked for any signs of damage by a structural engineer when the criterion is exceeded. It may be that the structure can withstand vibration levels far greater than the conservative criteria allows with no damage. Therefore, providing the structural engineer gives their sign-off, the works may continue inside the ‘Safe Working Distances.’ Vibration monitoring in this way will allow work to proceed faster with less delay. Further, monitoring is not expected to be required often as, typically the ‘Safe Working Distances’ will be met.

Based on the assumptions made in this report, only Waterloo Congregational Church and the Station Box are identified as receivers within the Cosmetic Damage zones during the use of excavator with hammer attachment, 10T vibratory roller and sheet piling. Vibration recommendations and vibration monitoring strategies are provided in Section 8.

7.2.2 Human Comfort

The actual vibration level received at a habitable area of a property, highly sensitive to geotechnical conditions, vibration source, dominant frequencies, dynamic characteristics of a specific structure and length of time vibration-intensive machinery will be in operation. Therefore, unlike noise, it is not possible to predict Vibration Dose Value (VDV) within habitable areas around the site. At receivers closer than the recommended ‘Safe Working’ for Human Response (provided in Table 19), the recommended vibration targets provided in Section 4.3 can be exceeded.

The 10T Vibratory roller operating in the vibration mode, has been determined as the piece of equipment that generates the highest vibration level. While some residential receivers located north and east of the site are identified to be within the Human Response zone during the operation of the vibratory roller, no receiver will be within this zone during the operation of the other vibration-intensive plant. Based on the ‘Safe Working’ for Human Response (provided in Table 19), Figure 10 below shows the extent of the receivers that may experience some vibration due to the operation of the 10T Vibratory roller.

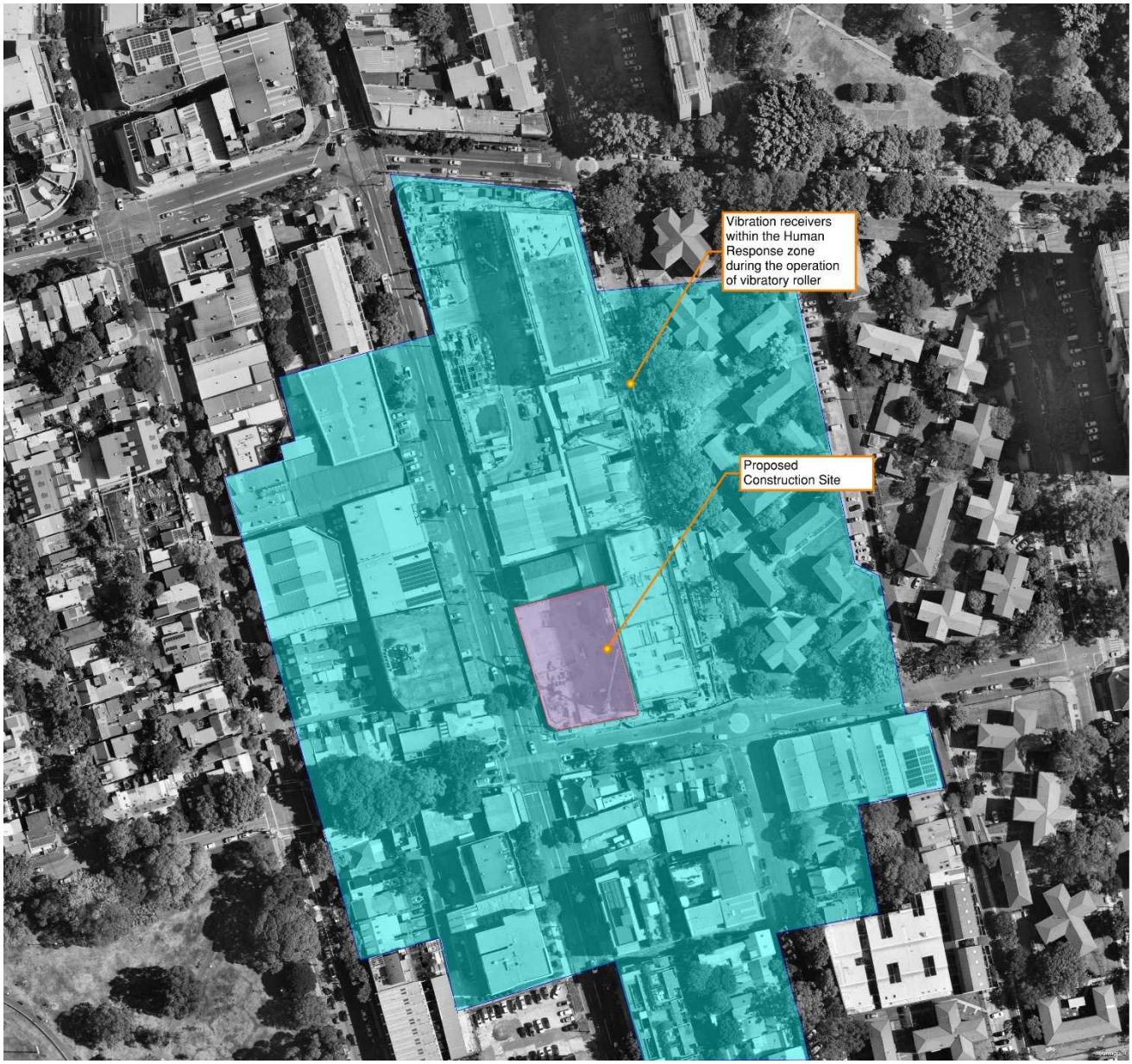


Figure 10 - Overview of the site and extent of the receivers closer than the Human Response zone for the operation of 10T Vibratory roller for the Southern Precinct Works

Discussion

While receivers within the Human Response zone in Figure 10 may briefly feel some vibration, exceedance of vibration targets provided in Section 4.2.1 are unlikely.

The typical operation of a roller is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. However, in the event of receiving a 'reasonable complaint' from an affected resident, site measurements and alternative equipment or method, should be considered. Vibration measurements should be done both within the site and at the receiver location to confirm the transmitted of vibration levels and VDV levels.

PART 2 – MANAGEMENT PLAN

8. Noise & Vibration Management Strategies

This construction noise and vibration management plan aims to minimise the impact of noise on the surrounding local environment. Project specific recommendations and required mitigation methods are outlined in the following subsections. Mitigation measures can be broadly categorized as physical measures and management measures.

Physical measures are action taken to reduce or control noise at the source or along its path. These measures focus on limiting the amount of noise that is generated, transmitted, or received by the surrounding noise sensitive receivers to reduce any adverse impact to their amenity. Typically, these will control measures implemented to the extent of the site by limiting line of sight to receivers.

Management measures are non-physical actions taken to minimise the impact of noise on the environment and the noise sensitive receivers. These measures focus on planning, organization, and communication aspects of noise management. Effective communication and planning can also help to maintain good relationships with nearby communities and mitigate any potential conflicts or complaints. Where objectives cannot be met and after implementation of all reasonable and feasible mitigation, there is still potential to impact noise sensitive receivers as a worst case.

Where noise and vibration objectives are predicted to be exceeded (See section 5.6 and 5.6.1 for noise and section 7.2 for vibration) physical mitigation measures may not be sufficient alone to sufficiently minimise the impact on the community. Therefore, it is important to note that a combination of these strategies is necessary to effectively the control the extent of noise impact. The noise and vibration management measures (8.1.2 and 8.2.2) shall also be followed.

8.1 Noise

8.1.1 Noise Physical Measures

The following physical measures should be implemented as a minimum to reduce the impact to the surrounding noise sensitive receivers.

- *Site Hoarding* - The use of both A-class and B-class hoardings are required to be installed to mitigate the impact of the highest predicted noise levels. The extent of the hoardings is indicated by the construction plan markups provided by John Holland and presented in Figure 11 and Appendix B.

  B-class hoarding is proposed to be installed to the extent surrounding the Southern Precinct to the North (Between the Southern Precinct and the Waterloo Congregational Church), West along Botany Road and South along Wellington Street. An additional A-class hoarding is proposed to the site boundary to the South and West.

  The construction of the barrier should be impervious of gaps and cracks, which would compromise its performance, and it will be comprised of acoustically suitable materials such as, 17 mm plywood. The barrier is able to reduce the noise levels experienced at the ground-level receivers directly around the site by 3-7 dB.

  Site shed being installed on the top of the hoarding on the work site boundaries can increase the effective height of the acoustic barriers shielding noise activities from receivers where feasible.

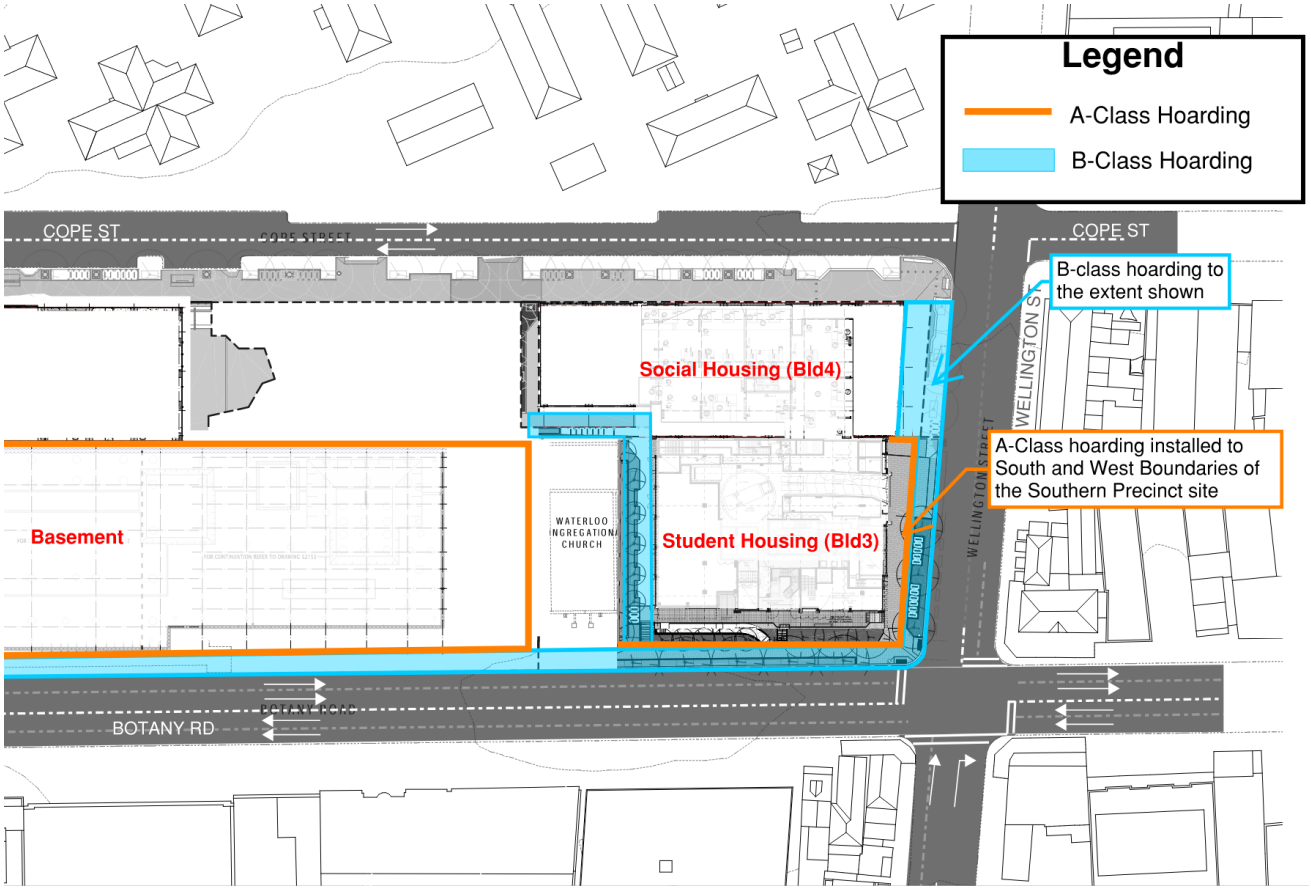


Figure 11: Extent of site hoarding for Southern Precinct works

- *Temporary barriers* - Barriers should be mobile and extend to a height 1 m above the noise source. These barriers should envelop the work location to ensure no direct line of sight to nearby receivers (ground level). All practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source. Note that these localised noise barriers are proposed in addition to the site bounding hoarding outlined above.

  Where high noise impacts are expected, the ICNG requires that all feasible and reasonable work practices be employed. It is noted that the performance of noise barriers is compromised where there is a direct line of sight to a noise source. However, to protect the receiver closer to the ground level, localised noise barriers should be utilised when the following equipment is in use:

  - Pneumatic handheld breaker
  - Concrete pump
- In addition to the sound attenuating barrier, at least one respite period such as, 12:00pm – 1:00pm or otherwise agreed with the community, should be offered per day during the most intensive periods of hammering and rock breaking. Frequent and proactive communication with the sensitive receivers is also encouraged, thus enabling tuning the works schedule to accommodate possible important religious events and allowing the tenants to prepare their expectations on the changing noise environment. More details regarding communication with the community can be found in Section 8.4.
- The concrete pump is proposed to be located along wellington street and is outside of the proposed hoarding, therefore, residential receivers at R3 will have direct line of sight to this equipment. Currently, the predictions provided in Section 5.6 have not considered any additional mitigation to these receivers as it is impractical to erect a barrier around this equipment, however, effort should be given to mitigate the direct path, which is expected to adversely impact these receivers, as far as feasible and reasonable.
- Selection of smaller equipment should be used where reasonable and feasible whilst maintaining efficiency of function.

- Where existing measures are not adequate to meet the noise goals, then modifications or alterations to the methodology should be implemented (e.g. consider use of alternative excavation methods, or alternate excavator attachments) or other negotiated outcomes with the affected community.
- Location of site access, egress and load out areas are to consider the noise sensitive receivers and where feasible and reasonable, to minimise the reversing movements within the site.
- All fixed plant at the work site is to be appropriately selected, and where necessary, fitted with silencers, acoustical enclosure and other noise attenuation measures in order to ensure that the total noise emission from the work site complies with conditions of approval requirements.
- Air brake silencers are to be correctly installed and fully operational for any heavy vehicle that uses Sydney Metro construction site.
- Regular maintenance on plant and equipment to include compliance checks on plant noise emissions in accordance with predicted noise levels. Service and performance records are reviewed as per Incoming Plant Inspection Checklist. All plant and equipment are to be maintained in good order and in accordance with manufacturer's recommendations. Plant or equipment causing excessive noise are to be modified or if required removed from site.

Australian Standard AS 2436 – 2010 *Guide to noise and vibration control on construction, demolition, and maintenance sites* recommends the following techniques that could be applied to minimise the spread of noise and vibration to potential receivers.

The preferred order of actions taken to mitigate excessive construction noise emissions. If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimised. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures, such as screens. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportable can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers, acoustic sheds, and enclosures.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. A few of these methods have been introduced in Figure 12 below.

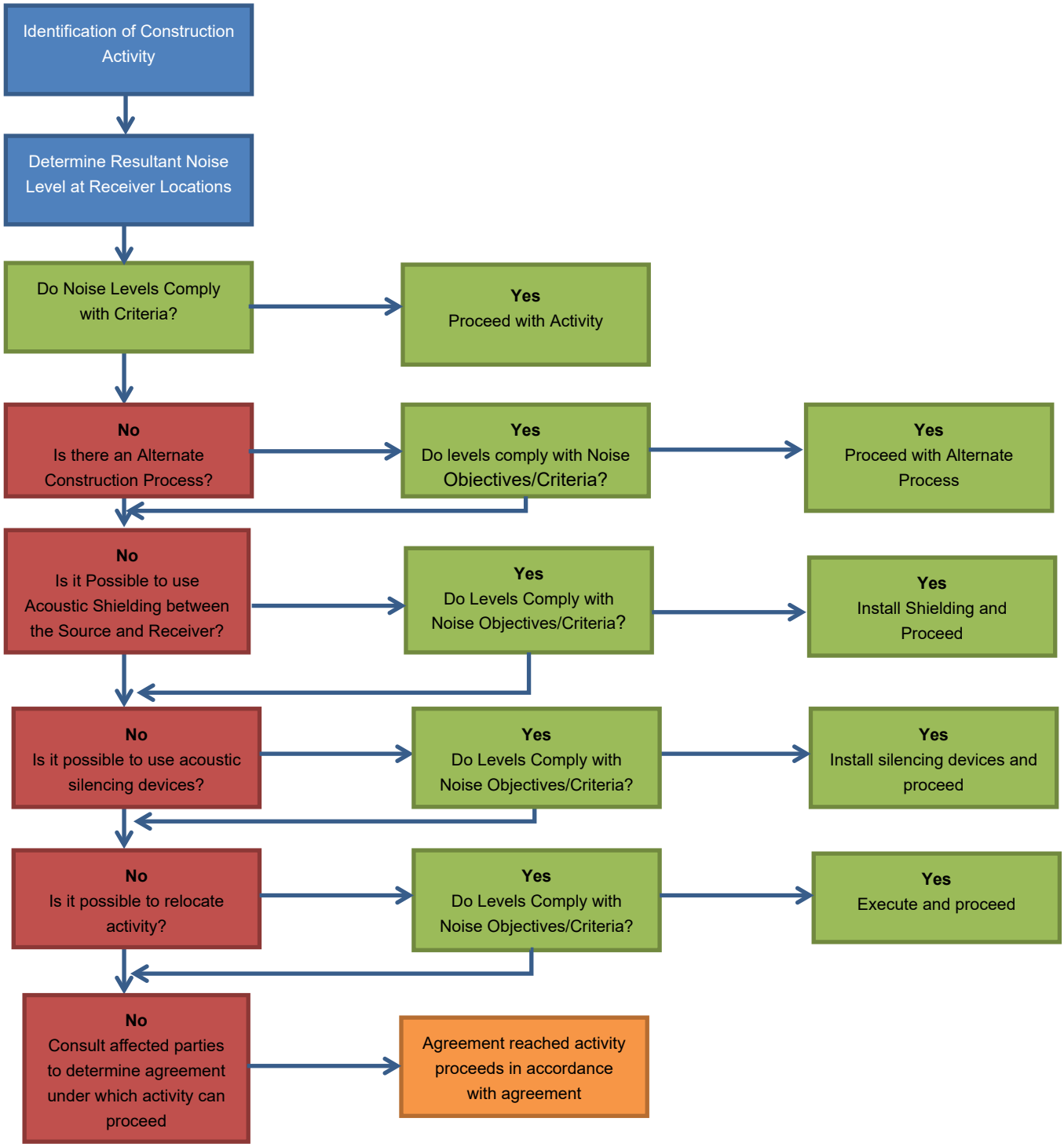


Figure 12: Noise Mitigation Management Flow Chart

Screening

On sites where distance is limited, screening of noise may be beneficial or even the only way to reduce construction noise impacts on the nearby receivers. Below, screening options for various situations have been introduced. Constructing and utilising these screening methods should be considered already during the planning stages.

Temporary buildings: One option to introduce screening is to position structures such as stores, storage piles, site offices and other temporary buildings between the noisiest part of the site and the nearest dwellings. Due to shielding provided by these buildings, some of the noise emission from the site can be reduced. If the buildings are occupied, however, sound insulation measures may be necessary to protect site workers inside the buildings.

Hoarding: Another way of implementing screening is to build hoarding that includes a site office on an elevated structure. This option offers superior noise reduction when compared with a standard, simple hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

Partial building structures: On some sites, partially completed or demolished buildings can be used as noise shields for certain equipment. A noisy, stationary plant can be placed in a basement, the shell of which has been completed, provided reverberant noise can be controlled. Where compressors or generators are used in closed areas, it is also necessary to ensure that the exhaust gases are discharged directly to the outside air and that there is good cross-ventilation to prevent the build-up of poisonous carbon monoxide fumes and to allow an adequate air supply to maintain efficiency when operating the equipment.

Earth mounds and embankments: Where constructing noise barriers and using partial building shells is not practical, a worthwhile reduction in noise can be obtained by siting the plant behind and as close as possible to mounds of earth, which may effectively screen any noise sensitive areas from the plant. These mounds can often be designed into the construction schedule or site arrangement for future landscaping.

Long, temporary earth embankments can provide quite an effective noise screen for mobile equipment moving, for example, on a haulage road. When the earthworks are complete, the earth mounds should be removed, if possible, with smaller quieter excavators. A noise barrier like this may be a more reliable method of noise control than the imposition of restrictions on throttle settings.

Where earth noise barriers are not practical due to lack of space, consideration should be given to the possibility of constructing temporary screens from wood or any equivalent material in surface density.

Equipment operating 24h: When it comes to water pumps, fans and other plant equipment that operate on a 24-hour basis, they may not be an irritating source of noise during the day but can be problematic at night. They should therefore be effectively screened by either situating them behind a noise barrier or by being positioned in a trench or a hollow in the ground. Again, generated reverberant noise must be minimised and adequate ventilation should be ensured.

General remarks:

In many cases, it is not practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant at the early stages of the project with protective features required to screen traffic noise.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and the receiver, and the material of which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected by at least ten times the shortest distance from the said property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend beyond the direct line of sight between the noise source and the receiver by a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are already predominantly located within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

Crane (diesel operated)

An appropriate silencer on the muffler and acoustic screen around the engine bay are recommended to attenuate the noise from the machine.

Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional "beeper", while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate:

- Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal frequency 'beep') are less intrusive when heard in the neighbourhood.
- Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.
- Non-audible warning systems (e.g. flashing lights, reversing cameras) may also be employed, provided that safety considerations are not compromised.
- Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.
- Spotters or observers.

The above methods should be combined, where appropriate.

Noise levels of plant for onsite construction works

For plant and equipment brought on to site, the maximum noise levels provided in Schedule 1 of the City of Sydney Construction Hours/Noise within the Central Business District Code of Practice 1992 (reproduced in Appendix E) shall not be exceeded.

John Holland may require the Subcontractor to produce a Certificate of Acoustic Performance issued by a manufacture, supplier or qualified Acoustic consultant and member of the Australasian Acoustic Society (AAS) or Association of Australasian Acoustical Consultants (AAAC) for any appliance before permitting its used, or continued use, on the site.

Measurements on site shall be made in accordance with Schedule 1 – City of Sydney Construction Hours/Noise within the Central Business District Code of Practice 1992 guidance i.e. An $L_{A10\ 1\ minute}$ (Average Maximum) measured at 7m from the point nearest to the appliance.

8.1.2 Noise Management Measures

Where the above physical mitigation measures are not sufficient to reduce the impact towards the target NMLs the following management measures shall be undertaken:

- Regular communication with nearby noise sensitive receivers about the construction activities can help to manage their expectations and minimize the impact of noise on their daily lives. This includes informing them of the duration and intensity of the noise and any measures being taken to control it. The following principles should guide the approach with stakeholders and the community:
    - Proactive – identify issues and build solutions into the project where possible
    - Accessible – ensure the team is accessible for the duration of the project
    - Responsive – respond in an affective way to individual concerns. Resolve issues to the satisfaction of all involved in the shortest time possible
    - Sensitive – Understand the needs of stakeholders and the community to minimise disruptions and impacts where possible.
    - Transparent – record, publish and make information easily accessible to the community
- Letterbox notifications to the potentially affected stakeholders and community about the construction works and what can likely be expected. regular communication should be maintained with the community throughout the extent of works as phases progress including the following:
    - Investigations carried out on site
    - significant milestones or any changes to the scope of work
    - start of noisy work and duration
    - changes to traffic conditions
    - mitigation measures implemented to minimise impact to receivers.
    - Any out-of-hours works
- Engagement and consultation within a COVID-19 environment by implementing online communication channels to support robust engagement and consultation.
- Effective scheduling can help to minimize the impact of noise on the nearby noise sensitive receivers. This may involve scheduling noisy activities during time when there are fewer people around. This would require consultation with the surrounding noise sensitive receivers to identify appropriate periods.
- Application of consent condition D7 should be managed on site
    - Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:
        a) 9am to midday, Monday to Friday;
        b) 2pm to 5pm, Monday to Friday; and
        c) 9am to midday, Saturday.
- Consent Condition D18:
    - Applicant must ensure that any work generating high noise impact (i.e. work exceeding a NML of $L_{Aeq\ 75dBA}$) as measured at the sensitive receiver must only be undertaken in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact,

where the location of the work is likely to impact the same receivers. For the purposed of this condition 'continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work subject of this condition.

- Where feasible and reasonable the layout and positioning of noise-producing plant and activities on the work site are organised to minimise noise emission levels. Also, avoidance of the use of noisy plant working simultaneously close together when close to sensitive receivers.
- Providing workers with training on noise control measures and equipment can help to minimize noise at the source. Workers should be trained on how to use equipment that produces lower noise levels and how to implement noise-reducing techniques.
- Site induction of all site personnel. Site Induction, Toolbox Talks and Team Meetings are to include a noise and vibration awareness/education component identifying impacts and implementation of control measures for the project. Site inductions are to include:
  - Project specific and standard noise and vibration measures
  - Construction hours of work
  - Nearest sensitive receivers
  - Relevant licence and approval conditions
  - Loading and unloading areas
- Deliveries will be carried out within the approved construction hours (considering the modification to the approved hours).
- Monitoring of noise levels can help to identify any issues and allow for adjustments to be made to the construction activities. This includes monitoring the effectiveness of the noise control measures and making changes as needed.
- Reduction of the hours of construction to minimise the prolonged daily exposure of the nearby noise sensitive receivers.
- Refer to Section 8.4 for additional information regarding the communication strategy with the community.

By implementing management measures, construction noise can be effectively controlled and the impact on the surrounding environment can be minimized. Effective communication and planning can also help to maintain good relationships with the surrounding noise sensitive receivers and mitigate any potential conflicts or complaints.

8.2 Vibration

Vibration can be more difficult to control than noise, and there are few generalisations that can be made about its control. However, General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Where, there is a high risk of cosmetic damage, site measurements and monitoring to confirm the site-specific vibration transmission and propagation characteristics between source and receiver locations through measurements are recommended.

8.2.1 Vibration Physical Measures

Physical mitigation measures to limit vibration are limited. The most effective physical measure is to break the physical connection between the source of vibration and the receiver. This can be achieved by means of cutting a narrow trench in between the source of vibration and the receiver. The trench may be cut using a rock saw or dug using an excavator for example.

8.2.2 Vibration Management Measures

The following vibration management measures are provided to complement physical mitigation measures on site and minimise vibration impact on human comfort from construction activities and reduce the risk of structural cosmetic damage.

Many of the management measures are similar to the items outlined in Section 8.1.2 regarding regular communication with the community and nearby sensitive receivers. Refer to Section 8.4 for additional information regarding the communication strategy with the community

Building condition surveys

Prepare a dilapidation report for both exterior and interior of the Waterloo Congregational Church and the following buildings if cannot be categorised as 'structurally sound'. The dilapidation report must be prepared prior to the commencement of construction works as a risk minimisation strategy for future complaints/claims of damage. The purpose of the dilapidation report is to capture the pre-existing condition of a property.

Equipment selection and construction method:

- Use less vibration emitting construction methods where feasible & reasonable.
- Where possible, turn off the vibration mode of rollers. Larger static rollers may be used instead of vibratory rollers if additional compaction is required.
- Drilling/stitch drilling/rock sawing may be able to be used instead of sheet piling or rock breaking, particularly where sheet piling is proposed to TC5 base immediately adjacent the Church.
- Condition of consent condition D7 shall be managed on site:
  - Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:
    d) 9am to midday, Monday to Friday;
    e) 2pm to 5pm, Monday to Friday; and
    f) 9am to midday, Saturday.
- Condition of consent condition D21 shall be managed on site:
  - Vibratory compactors must not be used closer than 30 metres from residential or heritage buildings unless vibration monitoring confirms compliance with the vibration criteria specified above and noted in Section 4.3. These limits apply unless otherwise outlined in the amended CNVMP applicable to the CSSI approval (CSSI 7400) or the project specific CNVMP required by condition B51.

Residential Receivers

Some residential receivers located north and east of the site are identified to be within the Human Response zone during the operation of vibratory roller only. Since the typical operation of a roller is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. However, where a ‘reasonable complaint’ related to the human response to vibration from an affected resident is received, long-term vibration monitoring at the receiver location is recommended. See Section 8.6 for monitoring strategies to ensure no adverse impacts occur.

Effective scheduling can help to minimize the impact of vibration on the nearby vibration sensitive receivers. This may involve scheduling vibration-intensive activities during time when there are fewer people around. This would require consultation with the surrounding vibration sensitive receivers to identify appropriate periods.

Waterloo Congregational Church

Waterloo Congregational Church is identified as a receiver within the Cosmetic Damage zones in the vicinity of the proposed works during the use of a 10T vibratory roller and sheet piling rig/excavator attachment. General vibration recommendations and vibration monitoring strategies are provided in Section 8.6.3.

Metro Station Box

The Waterloo Metro Station Box sits either side of the Cope Street Plaza and is considered a reinforced industrial structure and therefore, at low risk from cosmetic or structural damage. The piling and excavation activities for the basement are programmed to be complete before the Metro Station is open to the public and therefore, human comfort vibration impact is not considered further. There may be occasions where high vibration generating activities, such as sheet piling, 10T vibratory

roller and excavators using rock hammer attachments are proposed to take place within the 'Safe Working Distance' shown in column 1 of Table 29. When this occurs attended vibration monitoring should take place as per the recommendations in Section 8.6.3.

Vibration Monitoring

Short-term and Long-term monitoring programs are recommended in Section 8.6 where risk of cosmetic damage is identified. However, where a 'reasonable complaint' related to human response to vibration from an affected resident is received, long-term vibration monitoring at the receiver location is recommended.

- Consent Condition D20 stipulates that:
    - Vibration caused by construction at any residence or structure outside the Site must be limited to:

a) For structural damage when considering sensitive structures, the latest version of DIN 4150-3 (1992-02) Structural vibration – Effects of vibration on Structures.

b) For human exposure to vibration, the evaluation criteria set out in the Environment Noise Management Assessing Vibration: a Technical Guideline (Department of Environment and Conservation, 2006)

General management measures

- Guidance for measures available for the mitigation of vibration transmitted can be sought in more detailed standards, such as BS 5228-2 or policy documents, such as the NSW DEC Assessing Vibration: A technical guideline.
- Site Induction of all site personnel. Site Induction, Toolbox Talks and Team Meetings are to include a noise and vibration awareness/education component identifying impacts and implementation of control measures for the project. Site inductions are to include:
    - Project specific and standard noise and vibration measures
    - Construction hours of work
    - Nearest sensitive receivers
    - Relevant licence and approval conditions
    - Loading and unloading areas
- Providing workers with training on vibration control measures and equipment can help to minimize noise at the source. Workers should be trained on how to use equipment that produces lower vibration levels and how to implement vibration-reducing techniques.
- Complaints management will be as per the protocol outlined in the Waterloo Metro Quarter Community Communication Strategy Station Construction and Over Station Development.
- Reduction of the hours of construction to minimize the prolonged daily exposure of the nearby vibration sensitive receivers.

By implementing management measures, vibration associated with the construction works can be effectively controlled and the impact on the surrounding environment can be minimized.

8.3 Waterloo Congregational Church – Consultation

Effective communication with the adjacent Waterloo Congregational Church is crucial in minimising the impact of construction activities on their daily operations and ensure that any potential conflicts are mitigated. The communication strategy should include regular meetings and updates to inform the church administration of the construction activities. The construction team should also provide the church administration with contact information for any concerns or complaints that may arise during the construction period. Additionally, the construction team should be prepared to adjust the construction methodologies or implement additional noise and vibration control measures, as noted in the above sections, to accommodate the churches need, such as scheduling noisy activities during times outside of church service.

The following communication tools should be implemented during the design stages, and ongoing throughout the construction program as required:

- Pre- and post-construction property visual survey
- Regular progress updates
- Notifications
- Newsletters
- Ongoing detailed design meeting in relation to church operations and impacts.

In addition to the above the following is to be carried out prior to the commencement of the extended construction works as per the Modification of Development Consent (SSD-10437-MOD-3).

D6(b). Prior written agreement must be obtained from the owners/operators/administration of the Waterloo Congregational Church, including provisions for:

i. scheduling noisy activities during times that are outside of church services

ii. direct contact information for site foreperson for any concerns or complaints that arise during extended construction hours

iii. implementation of adjustments, including consideration of ceasing works, to construction methodologies and/or implementation of additional noise and vibration control measures to accommodate the Church's needs

8.4 Complaint Handling Procedures and Community Liaison

Community consultation will be carried out by the Waterloo Developer (WLD), with supporting information provided by John Holland Group (JHG) to ensure meaningful and effective consultation and communication processes are established and maintained throughout the life of the project in accordance with the Construction Environmental Management Plan (CEMP) and Project Planning Approval requirements. Community consultation and the fostering of positive cooperative relationships assists in managing impacts from noisier operations and alleviating community concerns thereby minimising complaints. This includes the following in consultation with the Sydney Metro:

- Periodic notification of construction activities
- Specific works notification prior to disruptive or noisy activities
- Community consultation meetings
- Notification in accordance with Waterloo Metro Quarter Southern Precinct SSD 10437 Approval Conditions:
  - D9 and D10 – Incident, Notification, Reporting and Response
  - D11, D12 and D13 – Non-Compliance Notification
  - Refer to Appendix D for the Construction Environment Management Plan (WMQ-SITE-JHG-PM-MPL-0005 Environmental Management Plan – Section 12 Improvement)

Prior to the commencement of vibration intensive activities that are likely to impact the amenity of the surrounding residents, notification should be provided to relevant landowners. These works are expected to include the use of the vibratory roller as assessed in Section 8.6.3. Notification should be in writing and provide general details of the works, dates and time where disruption could be expected. Evidence of the notification having been carried out should be documented, prior to commencement of works.

The Waterloo Developer (WLD) will take the lead on stakeholder and community liaison. JHG is to support the overall management and coordination of stakeholder community liaison and ensuring notifications and consultation are provided within adequate periods. JHG will display 24-hour phone number on site entry points.

All community consultation is to be in accordance with the Community Communication Strategy. Community Communication strategy is to be developed in accordance with contract requirements. Refer to CSWSWL-JHG-SWL-CL-PLN-000001 *Community Communication Strategy: Station Construction and Over Station Development.*

Table 30 presents the reporting and communication summary requirements during the project.

Table 30: Reporting and Communication Summary Requirements

Reporting & Communication	Frequency	Responsibility	Report To
Daily Prestart Meetings	Daily	Site Supervisor	Place on Noticeboard
Site Inductions	As Required	Project Manager / Safety Manager	Project Manager / Safety Manager
Monitoring Reports	As occurs	Site Supervisor	Project Manager / HSEQ Manager

All complaints handling is to be in accordance with the Waterloo Metro Quarter Community Communication Strategy Station Construction and Over Station Development, the Waterloo ISD CEMP and the Community Consultation Strategy. Complaints will be investigated, reported, documented, actioned and closed out as per the details provided in the Waterloo Metro Quarter Community Communication Strategy Station Construction and Over Station Development and CEMP.

As per the Condition D6(c) of the Modification of Development Consent (SSD-10437-MOD-3 SSD),

D6(c) Should noise complaint(s) be received and the complaint(s) be confirmed as connected with a non-compliance with Condition D5 and/or D6 after being substantiated by the Department's Compliance Team, the construction work occurring during extended construction hours in Condition D5 above must cease and may not recommence until:-

i. compliance with the conditions of consent has been established;

ii. compliance with the relevant noise management and mitigation measures identified in the Construction Noise and Vibration Management Sub-Plan (CNVMP) prepared under Condition C22 has been established; and

iii. it can be satisfactorily demonstrated to the Planning Secretary that any additional management and mitigation measures, as recommended by a qualified acoustic consultant, have been fully implemented.

Table 31 below outlines the communication activities and timeframes associated with each activities, as reproduced from the *Community Communication Strategy: Station Construction and Over Station Development* (CSWSWL-JHG-SWL-CL-PLN-000001). An internal review process will ensure the distribution of timely and accurate information within the required timeframes. The Key Issues and mitigation measures, as well as the proposed public communication and engagement tools outlined in the Waterloo Metro Quarter Community Communication Strategy (CSWSWL-JHG-SWL-CL-PLN-000001) has been included in Appendix F and Appendix G of this report.

Table 31: Communication Timelines

Communication timeframes	Timeframes
Planning – Community Communications Strategy	Uploaded on the WMQ website before major construction
Project contact details (1800-number, email and mailing address) hoardings, email updates, community notifications and newsletters	Ongoing
Letterbox notifications to potentially affected stakeholders and community about: • investigations (surveys, drilling, potholing) • vegetation clearing or tree removal • site establishment works including installing environmental controls • start of construction • significant milestones • changes to scope of work • noisy work • changes to traffic conditions • partial or full road closures • modifications to pedestrian routes, cycleways, and bus stops • out-of-hours work	Delivered monthly to a 200m radius Uploaded on Sydney Metro's website on the day notification is distributed Emailed weekly to distribution list with a weekly lookahead

• disruption of residential or business access • changes to parking arrangements • changing or disrupting utility services	
Traffic Signage and advising: • changes to pedestrian routes • impacts on cycle ways • changing traffic conditions • disrupted access to bus stops	Installed seven days before change
Traffic alert email advising of changes to traffic and access arrangements to transport and traffic stakeholders: • relevant authorities • transport operators (bus, coach, and point-to-point)	Issued seven days before change
Community email progress updates	At regular intervals according to the work activities, generally at least monthly
Condition surveys for eligible property owners	Reports provided to property owners no later than one month before construction commences
Utility service investigations and works – notification to utility authorities	Issued seven days before starting work
Emergency works – door knocks with written notice	Within two hours of starting emergency work
Project advertisements – as required to comply with approvals and advise of significant traffic management changes, detours, traffic disruptions or work outside of working hours contained in the environmental documents	Contact details advertised one month before start of construction Displayed seven days before change
Project update newsletters	Bi-annually
Project website	Updated as required

8.5 Site Inductions

To ensure that effective and consistent communication with the construction team and community, minimise the impact to the surrounding noise sensitive receivers, and mitigation measures are correctly implemented, a site induction is required. to all site personnel. Site inductions are required to ensure that all contractors, subcontractors and other personnel working on and visiting the site are aware of their obligations conveyed by this noise and vibration management sub-plan

The intent of the site induction is to raise awareness and educate site personnel by identifying the impacts of noise and vibration, and the implementation of project specific mitigation and control measures. Site inductions will include the following items to make site workers aware of the project's obligations as detailed in the Acoustic Noise and Vibration Management Plan:

- Site personnel should be made aware of the project specific and standard noise and vibration measures (i.e. site hoardings, localised barriers around high noise generating equipment)
- During periods of work which generate potential of high noise impact (I.e. work exceeding the highly noise affect criteria of L_{Aeq} 75dB) as measured at the nearby noise sensitive receivers. Works must only be undertaken in a continuous block of no more than 3 hours, with at least a 1-hour respite period between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers.
- Standard Construction hours of works
- Construction vehicles must not arrive and depart the site or surrounding residential precincts outside the established construction hours.
- Access pathways to site on the boundary (hoarding / gates) should remain closed at all times when not in use.
- Identification of the nearby noise sensitive receivers
- Complaint handling and communication procedures
- Relevant licence and approval conditions
- Location of loading and unloading areas
- Selection of low-noise tools where possible. All equipment should be well maintained (e.g. serviced, lubricated) to reduce noise.
- Site safety (i.e. Hearing Protection, limiting amount of time an individual is exposed to loud noise sources).

8.6 Noise & Vibration Monitoring Strategy

8.6.1 General Methodology

Noise and vibration levels should be monitored from time to time to ensure that noise generated as a result of remediation and construction activities does not disturb local businesses and residents.

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed at the affected property and on site adjacent to the affected receivers.

The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

Short-term monitoring - Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site, telling them when the noise and vibration criteria are exceeded. Thus, the selection of alternative method on construction or equipment selection is allowed in order to minimise noise and vibration impacts.

Long-term monitoring - Similarly to short-term monitoring, long-term monitoring provides real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded. Instead of someone being on site measuring, noise and vibration loggers are used. Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise and vibration monitoring is dictated by the local authorities.

Both methodologies are complementary and normally used simultaneously providing a significant amount of data via the long-term monitoring, but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

8.6.2 Noise Monitoring Program

Short-term noise monitoring program

Short-term noise monitoring is recommended to:

- Be carried out at no less frequent than monthly intervals, of attendant noise monitoring at the identified noise sensitive receivers during extended construction hours approved under Condition D5 and C22(c) i.
- Respond directly to complaints as part of the complaints handling procedure (Section 8.4 and Appendix A). The results of the short-term monitoring may indicate a requirement for long-term monitoring. This will be determined on a case-by-case basis with the input from the acoustic engineer.
- When a new noisy item of plant is brought onto site for the first time noise measurements may be required to determine compliance with Schedule 1 of the City of Sydney Construction Hours/Noise within the Central Business District (Appendix E).
- It is recommended that results of construction noise monitoring are reported on a quarterly basis. Where requested in response to complaints, real time monitoring results should be provided as soon as practicable .

Long-term noise monitoring program

It is expected that the surrounding noise sensitive receivers may be adversely impacted by the construction works, with noise levels exceeding the Highly Noise Affected criterion in some phases during the operation of Average Works. As such, long-term monitors are proposed to be installed on the site hoarding to Northern, Eastern and Southern sides of the site as detailed below in Figure 13.

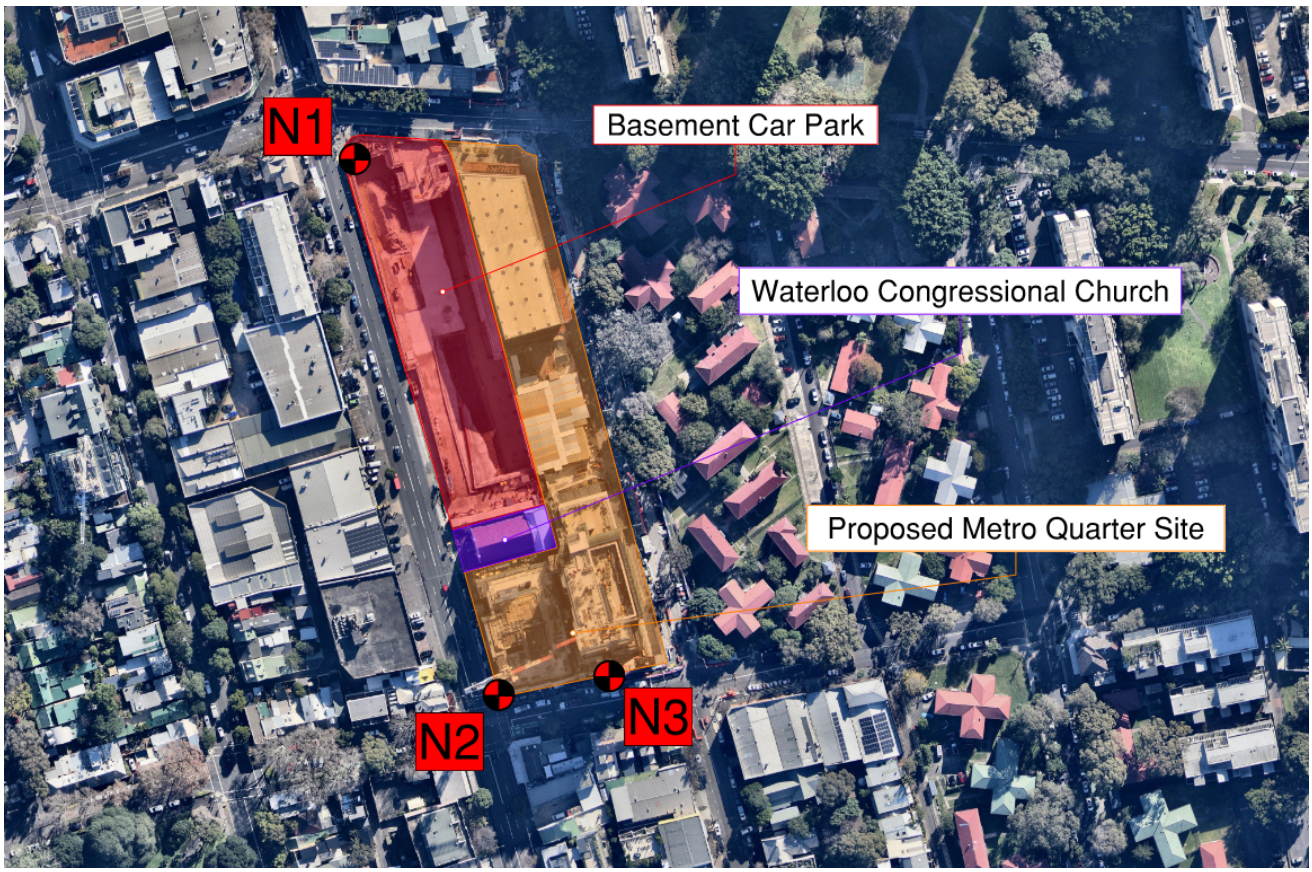


Figure 13: Long-Term Noise Monitoring

The long-term noise monitors are proposed to operate continuously throughout the extent of the construction works to assist in determining the impact of the noise associated with the construction works on the local environment and communities. Further to this, attended noise monitoring at the various noise sensitive receivers surrounding the site can be conducted as required to assist in tuning the works to minimize impact.

8.6.3 Vibration Monitoring Program

The most at-risk vibration sensitive receivers have been identified and monitors are proposed to be located as close as possible to these receivers. Given the more stringent criteria established for these receivers, compliance with values within these properties will ensure criteria will be met at all other receivers.

It should be noted that additional monitoring locations have been identified in Table 32 and Table 33 are in addition to what was outlined in *EIS Appendix K – Noise and Vibration Impact Assessment*. At the EIS level, the full extent of construction works (shoring and piling) were not fully known. As more information has been made available, a more detailed assessment has been able to be undertaken which forms the basis of this detailed construction assessment as opposed to the EIS which is conducted as a high-level assessment.

Considerations of Human Comfort

Based on the 'Safe Working' distances for Human Response (provided in Table 19), Figure 10 shows the extent of the receivers that may experience some vibration due to the operation of the 10T Vibratory roller. The typical operation of a roller is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. However, in the event of receiving a 'reasonable complaint' from an affected resident, site measurements and alternative equipment or method, should be considered. Vibration measurements should be undertaken both at close distance of the vibration generating equipment and at the complainant's receiver location. Depending on the nature of the complaint and the receiver location, long and/or short term monitoring will be required. Advice from the acoustic consultant should be sought to determine the correct type of vibration monitoring procedure.

Considerations of Cosmetic Damage

Based on the assessment provided in Section 7.2.2 and Figure 7, Short-term and Long-term monitoring programs are recommended where risk of cosmetic damage is identified.

Short-term monitoring program

To ensure that the vibration generated by the construction activities are capable of meeting the criteria presented in Section 4, Table 32 provides recommended short-term vibration monitoring at locations to be carried out at start of relevant works and when equipment is working at the closest location to the receiver.

Table 32 - Recommended short-term vibration monitoring locations

Sensitive Receiver Details	Equipment
• 123 Botany Road • 130 Botany Road • 122 - 134 Wellington Street	• 15t Excavator with hammer • Sheet Piling

Long-term monitoring program

To ensure that the vibration generated by the construction activities adhere to the criteria presented in this report, Table 33 provides recommended long-term vibration monitoring locations for high vibration receivers.

Table 33 - Recommended long-term vibration monitoring locations

Sensitive Receiver Details	Equipment
Waterloo Congregational Church*	• 15t/ 40t Excavator with hammer • 15t Excavator with bucket • Bored piling
	• Sheet Piling • 10T Roller – vibratory
Metro Station Box	• 15t/ 40t Excavator with hammer • Sheet Piling • 10T Roller – vibratory
123 Botany Rd (I12070) & 122-136 Wellington St (I2296)	• 10T Roller – vibratory

Note: * There is currently a long-term vibration monitor is already installed at the Church which is accessed and managed by John Holland.

- A suitable location is a location where equipment is working at closest location to the receiver to assess risk.
- As part of the long-term monitoring procedure, short-term attended monitoring at the start of works to establish the safe working distances are recommended. To prevent high vibration levels at a receiver, it is advised to create a safe working distance by moving equipment closer to it in a gradual approach. If the criterion is exceeded but no damage is observed then a view may be taken to allow the work to proceed at progressively closer distances.
- Additional vibration monitoring is proposed to be conducted within the Southern Precinct during the operation of the Vibratory Rollers. The monitors will require calibration on site, with simultaneous attended vibration measurements

to allow for installation of the monitor on-site, in lieu of at the nearest receivers identified on Wellington St. This monitoring is conducted to demonstrate compliance with both the structural damage and human comfort criteria in accordance with DIN 4150- 3, Assessing Vibration: A Technical Guideline (DEC), and conditions D20 and D21 stipulated by the DPE.

  - Vibratory Rollers must not be used closer than 30m from the residential or heritage buildings unless compliance is demonstrated as a result of the vibration monitoring
  - The additional long-term vibration monitoring is only required whilst the vibratory roller is on site and in operation. The monitor can be removed once the equipment is no longer required for construction.

- The monitors should be configured to send a text message via SMS to the site manager or other nominated responsible party once the criterion for each monitor has been breached. By doing so, personnel on site get notified and can act promptly to stop the vibration causing activity and assess the situation as quickly as possible. Action can then be taken to reduce vibration levels and assess the risk of damage before resuming the activity if no further risk is perceived.

- It is important for personnel on site to be aware of vibration triggers that occur within the construction periods, so that they can adjust activities and mitigate impact on the surrounding receivers in a prompt manner.

- Monitoring equipment shall be equipped with visual and/or audible alarms that are triggered when the levels of vibration exceed the control criteria presented in Section 4.3. An operator warning level should be set to 70% of the allowable relevant criteria established in Section 4.3.

- The attended vibration monitoring should be undertaken by a qualified acoustic consultant.

General monitoring program notes

- monitoring programme as shown above is to be carried out at locations within the premises listed in Table 32 and Table 33 as agreed with the Acoustic Engineer and Contractor. Recommended measurement locations:

    - In consideration of cosmetic or structural damage: on the foundations of the most affected building as appropriate

    - In consideration of human comfort: on the occupied floor of the closest building as appropriate

- All vibration monitoring data should be recorded, and the results should be maintained to assess compliance with the criteria.

- If required, a monitoring system to measure vibration and assess the levels against the criteria for human comfort should be implemented.

- Where monitoring is triggered due to attended or un-attended vibration monitoring then the following approach to manage potential vibration impacts on structures shall be conducted prior to the commencement of those works:

    - If any exceedance of the cosmetic building damage criterion is measured, that vibration activity will cease as soon as safe and practicable to do so. A structural engineer should then undertake an inspection to assess relevant structures for movement and damage. Work can resume when and if the risk of damage can be discounted to a low risk and continued monitoring occurs to keep the activity under control.

- Where vibration-intensive equipment is to be used within or close to the Safe Working distances defined in Section 7, It is advised to consult a vibration specialist to determine the proper safe working distances based on attended vibration measurements on site.

8.7 Subcontractor Responsibilities for Noise and Vibration Management

This Construction and Vibration Management Plan (CNVMP) is appended to the document register forming part of subcontracts prepared and administered by John Holland in the delivery of the Waterloo Over Station Development (OSD) John Holland's obligations arising from the CNVMP are passed down onto subcontractors wherever applicable.

8.8 Future Professional Acoustic Input

Regular professional acoustic input into the construction planning and construction activities is essential for successful project outcomes. The input can ensure that the project stays on track and that any issues or challenges are identified and addressed as early as possible and resolved in a timely manner.

Professional acoustic input including to review attended monitoring results and advise the project where required:

- Attended monitoring to be undertaken by a competent person, professional input from acoustic consultant is required to review results where there is a complaint or where requested in accordance with condition C22 (c) (iii);
    - A major new construction activity starts on-site,
    - Or new noisy plant/machinery is brought onto site (Appendix E),
    - Or when there is any major deviation from the noise and vibration assessment scenario presented in Section 5 and Section 7 of this plan.
- In the event of a complaint, John Holland Group will seek advice from a professional acoustic consultant/ engineer regarding any necessary follow-up actions and additional monitoring if required.

9. Conclusion

A Construction Noise and Vibration Impact Assessment has been provided for the assumed typical construction works for the Southern Precinct over station development (OSD) as part of the Waterloo Metro Quarter Site.

The details of the noise and vibration assessments undertaken to predict the impacts on sensitive receivers have been presented in Sections 5 to 7.

- Noise levels are predicted to exceed the Highly Noise Affected criterion (75 dBA) during all the assumed stages of work at the nearest identified receivers for both average- and worst-case scenarios. Except in the case of the structure stage 6 where the Average-Case is expected to demonstrate compliance across all the adjacent receivers. However, exceedance is still expected during the worst-case scenario.
- ICNG does not set out the Highly Noise Affected Criterion for non-residential receivers. Nevertheless, it should be noted that noise levels are predicted to exceed the Highly Noise Affected criterion (75 dBA) during many of the proposed stages of work at the nearest identified non-residential (i.e. commercial, retail and places of worship) receivers for both average- and worst-case scenarios.
- Noise levels are predicted to exceed the NML during all the assumed stages of work at the nearest identified receivers for various works during both average- and worst-case scenarios.
- Noise levels during Standard Hours of work are expected to exceed the Noise Management Level by up to 31 dB during the average noise emissions; and up to 37 dB during the Worst-Case assessment scenario for the adjacent Waterloo Congregational Church;
- Noise levels during Standard Hours are expected to exceed the Noise Management Level by up to 21 dB during the Average-Case noise emissions; and up to 25 dB during the Worst-Case assessment scenario for the nearby residential receivers;
- Highest noise levels are produced during the use of concrete/road saws and excavators with breaker attachments;
- The results for the assessment indicate that airborne noise impacts associated with the OOH works are expected to exceed the noise management levels for some construction activities during different periods. All reasonable and feasible measures should be applied on site to assist in minimising the overall noise emissions on-site.
- The potential sleep disturbance impacts have been assessed for the proposed night-time period works and are not expected to result in sleep awakenings.

- The extension on standard hours will cause a 1-2 dB noise exceedance to nearby residential receivers. An exceedance of 1-2dB is considered negligible as changes in loudness of ≤2dB are near imperceivable to human hearing. These noise levels are therefore acceptable.

Based on the above, the proposed construction works have the potential to give rise to adverse noise impacts at identified receivers. Therefore, all reasonable and feasible measures should be applied on site to assist in minimising the overall noise emissions on-site, as per the recommendations in Section 8. It is noted, however, the Average-Case scenario is expected to represent the average noise expected from the entire site at any receiver and expected to representative of the longer-term average noise emissions. Therefore, this situation represents typical construction noise emissions, which are predicted to be below the Highly Noise Affected criterion at the nearest identified residential receivers in most instances.

A construction traffic noise impact on the surrounding roads has been qualitatively assessed. The traffic noise generated in association with the construction of the proposed development is unlikely to give rise to an adverse impact to nearby residents.

Some residential receivers located surrounding the site (South, West and East) are identified to be within the Human Response zone during the operation of the vibratory roller only. Since the typical operation of a roller is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. However, as discussed in Section 8.6.3 additional vibration monitoring is proposed to be conducted within the southern precinct during the operation of the vibratory rollers and calibrated to be representative of the conditions of the nearest sensitive receivers.

Should different construction equipment to those proposed in Table 15 be used, long-term and attended vibration monitoring may be required. This is to ensure that the acceptable levels of vibration are maintained during the use of the vibration intensive equipment, as per vibration limits set out in Section 4.

Vibration monitoring is proposed during the use of the vibratory roller on site. Once these works are completed and vibratory roller equipment is no longer required on site, the monitor can be removed, and other works can continue as planned.

To reduce the noise and vibration impacts on the sensitive receivers, noise and vibration management strategies have been proposed in Section 8. Erecting a sound attenuating barrier around the site and localised barriers around stationary equipment are recommended.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of equipment/machinery and modifications to the proposed construction program.

Appendix A Complaints Response Procedure (example)

All complaints regarding the relevant stage of the construction noise and/or vibration must be recorded in a form with the contact details of at least two main points of contact (e.g. the appointed contractor/developer) provided to the affected parties.

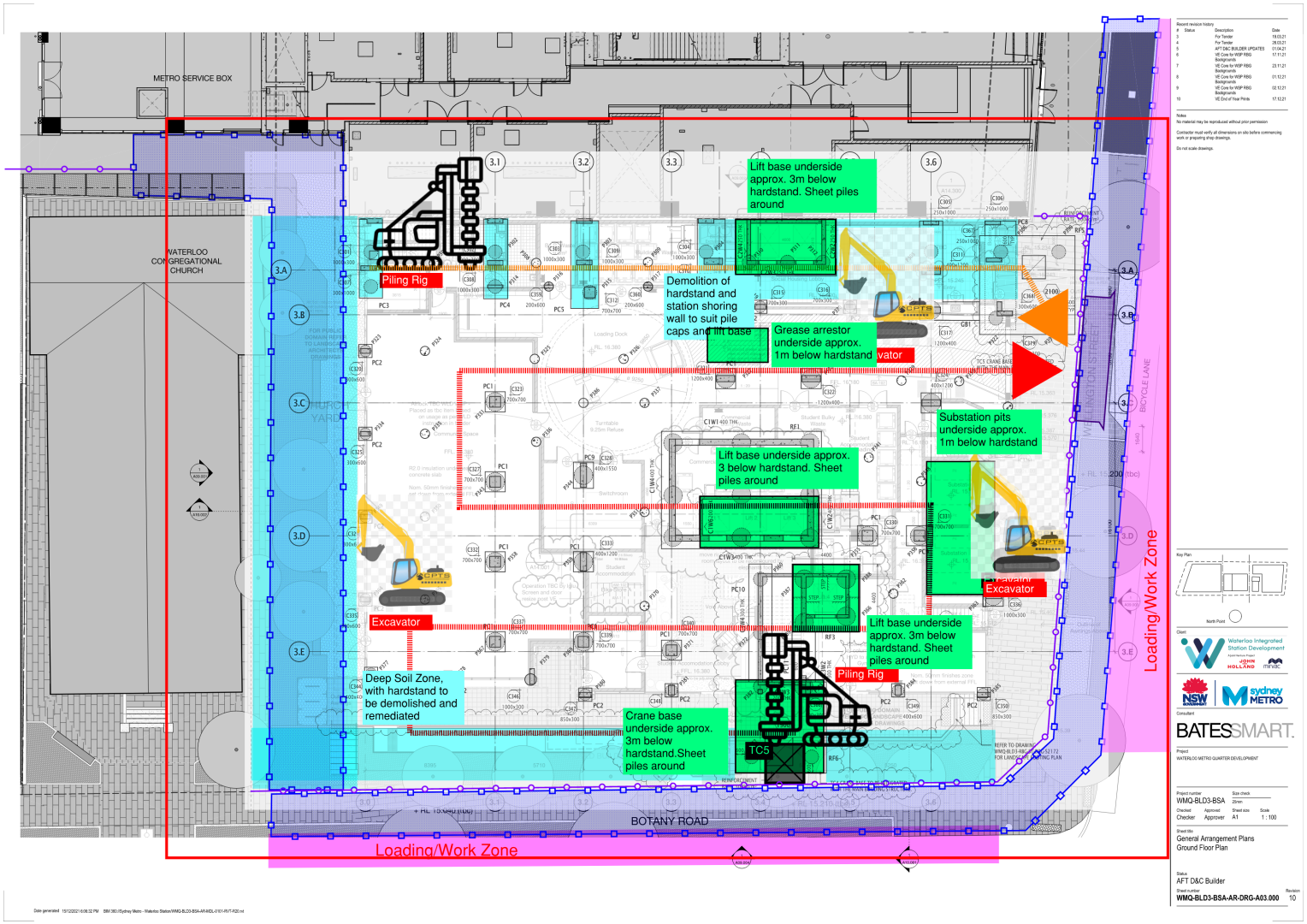
All construction noise and/or vibration complaints should be documented and the following information should be recorded:

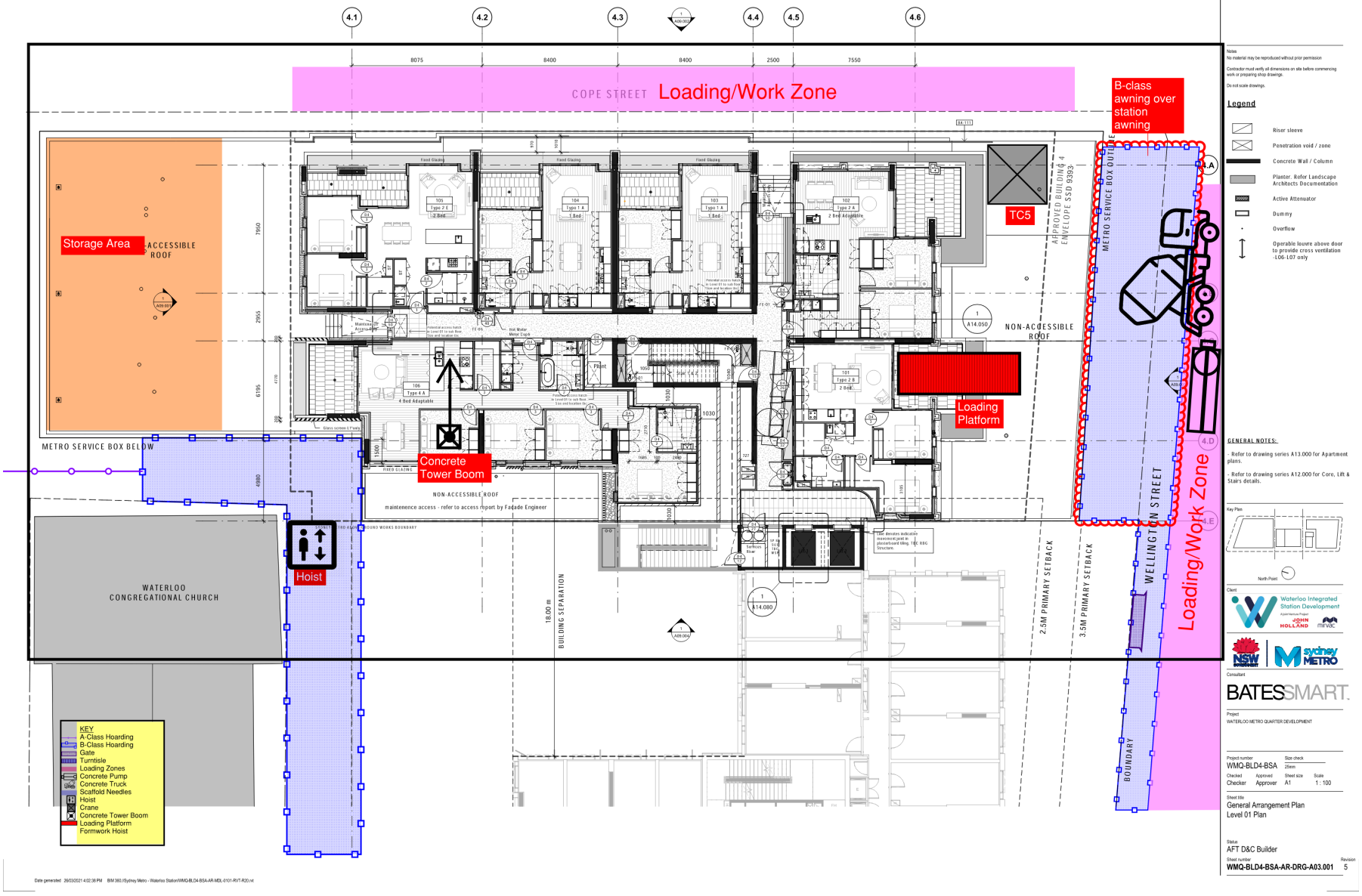
- The name, address and contact details of the complainant;
- Time and date the complaint was received and who received it;
- Time and date of the activity that caused the complaint;
- The complainant's description of the activity and its effects;
- Any relief sought by the complainant (e.g. scheduling of the activity).

All complaints should be investigated by the appointed contractor/developer representative as soon as practicable using the following steps:

- Assess if the problem can be resolved by reducing noise levels through implementation of the various work practises detailed in this Construction Noise Management Plan.
- Advise the complainant of the action taken and record all details of the conversation.
- Identify the relevant activity and review the activity log to verify the complaint (or otherwise)
- Where it is not practical to stop work immediately, the complainant should be kept updated regularly during the time it takes to stop the activity.
- Review the predicted noise and/or vibration levels to determine if the activity was identified.
- Review the mitigation and management measures in place to ensure they have been applied.
- Review the relief sought by the complainant. Adopt further mitigation and management measures as appropriate.
- Consider attended monitoring to verify the underlying reference level assumptions
- Report the findings and recommendations to the Project Manager, implement changes and update this CNVMP as appropriate
- Report the outcomes of the investigation to the complainant, identifying where the relief sought by the complainant has been adopted or the reason(s) otherwise.

Appendix B Construction Plans




COPE STREET
Loading/Work Zone
B-class awning over station awning
Storage Area
ACCESSIBLE ROOF
TC5
APPROVED BUILDING 4 ENVELOPE SSD 9393
METRO SERVICE BOX OUTLINE
NON-ACCESSIBLE ROOF
Loading Platform
Concrete Tower Boom
METRO SERVICE BOX BELOW
maintenance access - refer to access report by Façade Engineer
Hoist
WATERLOO CONGREGATIONAL CHURCH
18.00 m BUILDING SEPARATION
2.5M PRIMARY SETBACK
3.5M PRIMARY SETBACK
WELLINGTON STREET
Loading/Work Zone
BOUNDARY
KEY
A-Class Hoarding
B-Class Hoarding
Gate
Turntisile
Loading Zones
Concrete Pump
Concrete Truck
Scaffold Needles
Hoist
Crane
Concrete Tower Boom
Loading Platform
Formwork Hoist
Legend
Riser sleeve
Penetration void / zone
Concrete Wall / Column
Planter. Refer Landscape Architects Documentation
Active Attenuator
Dummy
Overflow
Operable louvre above door to provide cross ventilation - L06-L07 only
GENERAL NOTES:
- Refer to drawing series A13.000 for Apartment plans.
- Refer to drawing series A12.000 for Core, Lift & Stairs details.
Waterloo Integrated Station Development
BATESSMART.
WATERLOO METRO QUARTER DEVELOPMENT
WMQ-BLD4-BSA
General Arrangement Plan
Level 01 Plan
AFT D&C Builder
WMQ-BLD4-BSA-AR-DRG-A03.001
5


COPE STREET
North Station Box
South Station Box
TSE removed
Pile cap & bases excavation
RAGLAN STREET
Archaeo
Basement floorplate remaining
Piling guide wall
Remediation area
WATERLOO CONGREGATIONAL CHURCH
Remediation area
WELLINGTON STREET
BOTANY ROAD
Demolition
Bld 3 and Bld 4:
- Remediation
- Pile cap and bases excavation
- Pile cropping (Clouded Red)
- Station capping beam and shoring wall (TSE) removed
Waterloo Integrated Station Development
sydney METRO
SMART.
WMQ-BLD3-BSA
Site Plan
Site Location Plan
AFT D&C Builder
WMQ-BLD3-BSA-AR-DRG-A02.001


COPE STREET
North Station Box
South Station Box
RAGLAN STREET
WELLINGTON STREET
WATERLOO CONGREGATIONAL CHURCH
BOTANY ROAD
Piling, Shoring and Excavation
Bld 3 and Bld 4:
- Remediation
- Sheet piling in orange
- Pile cap and bases excavation
- Pile cropping (Clouded Red)
- Station capping beam and shoring wall (TSE) removed
AFT D&C Builder
WMQ-BLD3-BSA-AR-DRG-A02.001

Appendix C Structural Engineer's Assessment of Waterloo Congregational Church

From: James Taylor <jtaylor@jamestaylorassociates.com.au>
Sent: Thursday, August 3, 2017 4:52:41 PM
To: Elliot Nuberg
Subject: Waterloo Congregational Chapel, Botany Road

Elliot
As you are aware I attended site yesterday morning in company with Brendan Jolliffe from Delta Group and several other parties.
I inspected the general condition of the church building.
There are several very minor brick cracks in brickwork which are certainly not new.
One, internal, lies over the lintel leading to the kitchen at the rear of the church.
Upstairs in the rear of the church there is cracking evident around some of the windows.
There is evidence of other very minor cracks over some of the windows in the external skin.
These have been repaired at some stage in the past.
However, the cracking described above represents very minor distress in the building fabric.
Generally the building is in sound condition and obviously adequately founded. Demolition works alongside, as planned, would not need to have any extra conditions placed upon them other than the standard care applied to building or demolition works abutting heritage buildings.
Should you require any further information please contact me
James
--

James Taylor

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Appendix D Incidents, non-conformity and corrective action

12 Improvement

12.1 Incidents, non-conformity and corrective action

EMS reference
Non-conformance and Corrective Action JH-MPR-SQE-007
Incident and Event Management JH-MPR-SQE-010

When a nonconformity (including an incident, or a verified complaint) occurs, the Project shall:

- react to the nonconformity and, as applicable:
  - take action to control and correct it;
  - deal with the consequences, including mitigating adverse environmental impacts;
- evaluate the need for action to eliminate the causes of the nonconformity, in order that it does not recur or occur elsewhere, by:
  - reviewing the nonconformity;
  - determining the causes of the nonconformity;
  - determining if similar nonconformities exist, or could potentially occur;
- implement any action needed;
- review the effectiveness of any corrective action taken;
- make changes to the environmental management system, if necessary

Corrective actions shall be appropriate to the significance of the effects of the nonconformities encountered, including the environmental impact(s).

12.1.1 Compliance Reporting

The Project shall retain documented information as evidence of:

- the nature of the nonconformities and any subsequent actions taken;
- the results of any corrective action

Nonconformities will be documented internally using the resources outlined in Table 16 Nonconformity management.

Table 16 Nonconformity management

Required Project documentation	Responsibility	JH tools to be used by Project to manage documentation
Event and Incident Records	Project Environment Representative	Soteria
Non Conformance (system) Records	Project Environment Representative	Soteria
Actions Arising	Project Environment Representative	Soteria

12.1.2 Reporting Non-Compliances

The monitoring and reporting programme prepared in accordance with the Compliance Reporting Post Approval Requirements (Department 2020) will be implemented during the project. Compliance Reports of the project will be carried out in accordance with the Compliance Reporting Post Approval Requirements (Department 2020).

DPE must be notified in writing to compliance@planning.nsw.gov.au within seven days after John Holland becomes aware of any non-compliance with the SSD approvals. Notification to DPE will be completed by WLD as the Proponent.

The Certifying Authority must also notify DPIE in writing to compliance@planning.nsw.gov.au within seven days after they identify any non-compliance. The notification must identify the development and the application number for it, set out the condition of consent that the development is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.

12.1.3 Reporting Incidents

DPE must be notified in writing to compliance@planning.nsw.gov.au immediately after John Holland becomes aware of an incident. Notification to DPE will be completed by WLD as the Proponent. The notification must identify the development (including the development application number and the name of the development if it has one) and set out the location and nature of the incident. Subsequent notification must be given and reports submitted in accordance with the requirements set out in Appendix 6

12.2 Accountable Culture Tool (ACT)

EMS reference
Incident and Event Management JH-MPR-SQE-010
Counselling and Disciplinary Procedure JH-MPR-PPL-012

The Accountable Culture Tool (ACT) is designed for line managers to help them to understand, categorise and address appropriate actions of their staff, work force and subcontractors in a fair and just way.

The ACT is a step-by step decision making tool that provides managers with a structured process to address an event and the people involved in a constructive way and not simply react on the outcome. It also encourages the recognition of positive performance. The management of the ACT is outlined in Table 17.

Table 17: Accountable Culture Tool management

Required Project documentation	Responsibility	JH tools to be used by Project to manage documentation
Event Records	Project Environment Representative	Soteria
Reward and recognition records	HR Representative	Success Factors Aconex
Counselling and disciplinary records	HR Representative	Success Factors Aconex

12.3 Continual improvement

EMS reference
Monitoring and Review JH-MPR-SQE-002
Project Completion Procedure JH-MPR-PMA-016

The Project will continually improve the suitability, adequacy and effectiveness of the John Holland EMS to enhance environmental performance. This will be documented and managed using the tools outlined in Table 18.

Table 18: Continual improvement

Required Project documentation	Responsibility	JH tools to be used by Project to manage documentation
Actions Arising	Project Environment Representative	Soteria
Lessons Learned	Project Environment Representative	SharePoint – HSE Alerts and Lessons Learned & Workplace

Appendix E City of Sydney Construction Hours/Noise within the Central Business District – Schedule 1

Group A (See Note 2)	Group B 90dB(A)	Group C 85dB(A)	Group D 80dB(A)	Group E 75dB(A)	Group F dB(A)
Pile Drivers Hydraulic Hammers Machine mounted rock breakers Sand blasters Steam Cleaners Mole borers	Earthmoving equipment of enginer capacity above 200kW Warning sirens* Reversing alarms+ Trucks	Impulsive tools – air, electric or hydraulic Earthmoving equipment of engine capacity between 100kW and 200kW NEP Explosive power tools Impact wrenches Refuse chutes* Scabbers Chain saws Rock drills	Concrete agitators Concrete pumps Concrete saws Cranes (fixed) Cranes (mobile) Earthmoving equipment up to and including engine capacities of 100kW NEP Concrete Vibrators Portable hand tools Vibratory compacters	Air compressors above 170L/s capacity Construction dumpers over 1m^3 capacity Public address system* Internal combustion or electrically driven equipment (unless group elsewhere) over 14kW NEP	Air compressors up to 170L/s capacity Fluid pumps Internal combustion or electrically driven equipment (unless group elsewhere) up to 14kW NEP

* to be measured at the site boundary closest to eh affected area.

+ Reversing alarms must be controlled so that noise levels produced do not exceed the background sound level by more than 10dB(A)

Notes:

1. Where any appliance is unable to comply with the allowable noise level, para 43 applies.
2. A Certificate of Acoustic Performance shall be provided for each appliance listed in Group A.
3. All noise levels are to be $L_{A\ av\ max}$ (1 minute) measured at 7m from the point nearest to an Appliance.
4. “NEP” means the Net Engine Power and shall be determined in accordance with Australian Design Rule No.28/00 External Noise of Motor Vehicles, Other Than L-Group Vehicles dated March 1989

Para 43

Where an Applicant is required to undertake Noise Monitoring during Category 2, 3 and 4 Hours, the Applicant must ensure that Noise Monitoring is conducted:

a. During the hours required;
b. At the locations (if any) specified;
c. By a Noise Monitoring Technician; and
d. In accordance with Form B

Appendix F Communication - Key Issues and Mitigation Measures

Refer to the Waterloo Metro Quarter Community Communication Strategy prepared by John Holland.

Appendix G Public Communication and Engagement Tools

Refer to the Waterloo Metro Quarter Community Communication Strategy prepared by John Holland.

w

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Stantec

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stantec.com/australia

Department of Planning, Housing & Infrastructure

Our ref: SSD-10437-PA-34

Mr Ryan Thomas
Project Director
WL Developer Pty Ltd
Level 28/200 George Street
Sydney NSW 2000

9 July 2024

Southern Precinct Detailed Design SSDA - Condition C22 - Updated CNVMP Sub-Plan

Post Approval SSD-10437-PA-34

Dear Mr Thomas,

I refer to your submission dated 28 June 2024 seeking endorsement of an updated CNVMP Sub-Plan prepared in accordance with Condition C22 of the above project.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of Condition C22.

Accordingly, as the nominee of the Planning Secretary, I endorse the updated CNVMP Sub-Plan prepared by Stantec dated 28 June 2024.

If you wish to discuss the matter further, please contact Bonnie Hale on 8275 1998.

Yours sincerely,

Russell Hand
Principal Planner
Key Sites and TOD Assessments

As nominee of the Planning Secretary